HEATING AND VENTILATING

JUNE 1930

LIBRARY
STATE COLLEGE
AND APP SCIENCE

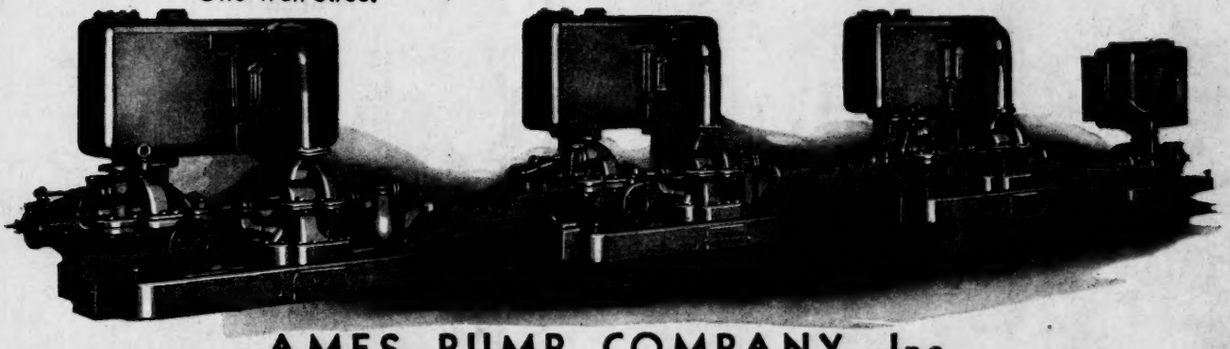
ONE OF THE
WORLD'S TALLEST BUILDINGS

Irving Trust Company Building
One Wall Street

Located on the most valuable ground in the world justified the highest talented engineering and equipment.

Therefore, Ames was selected.

Architects — Voorhees, Gmelin & Walker
Engineers — Meyer, Strong & Jones
Contractor — Baker, Smith & Company
Builders — Marc Eidlitz & Son, Inc.

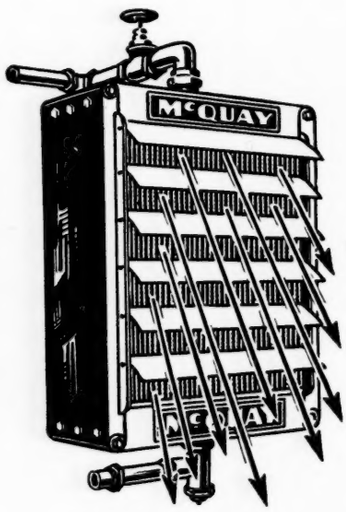


AMES PUMP COMPANY, Inc.
30 CHURCH STREET NEW YORK CITY
Affiliated with
AMERICAN LOCOMOTIVE COMPANY

Index, Page 3 Engineers Specifications Index, Pages 156-160 Table of Contents, Page 67

5 Point Superiority

Unit Heaters have proved their unusual efficiency in so many factories, warehouses, garages and salesrooms that it is only a question of which heaters to select. In making a selection consider carefully these 5 points of superiority provided *only* by McQuay.



Off the floor, out of the way, this one McQuay weighing less than 150 pounds will heat 2500 sq. feet—as much as 600 pounds of cast iron.

Built in sizes equivalent to from 50 to 2000 sq. ft. —in many different types —there is a McQuay for every purpose. Also condensing and drying equipment to meet particular needs.

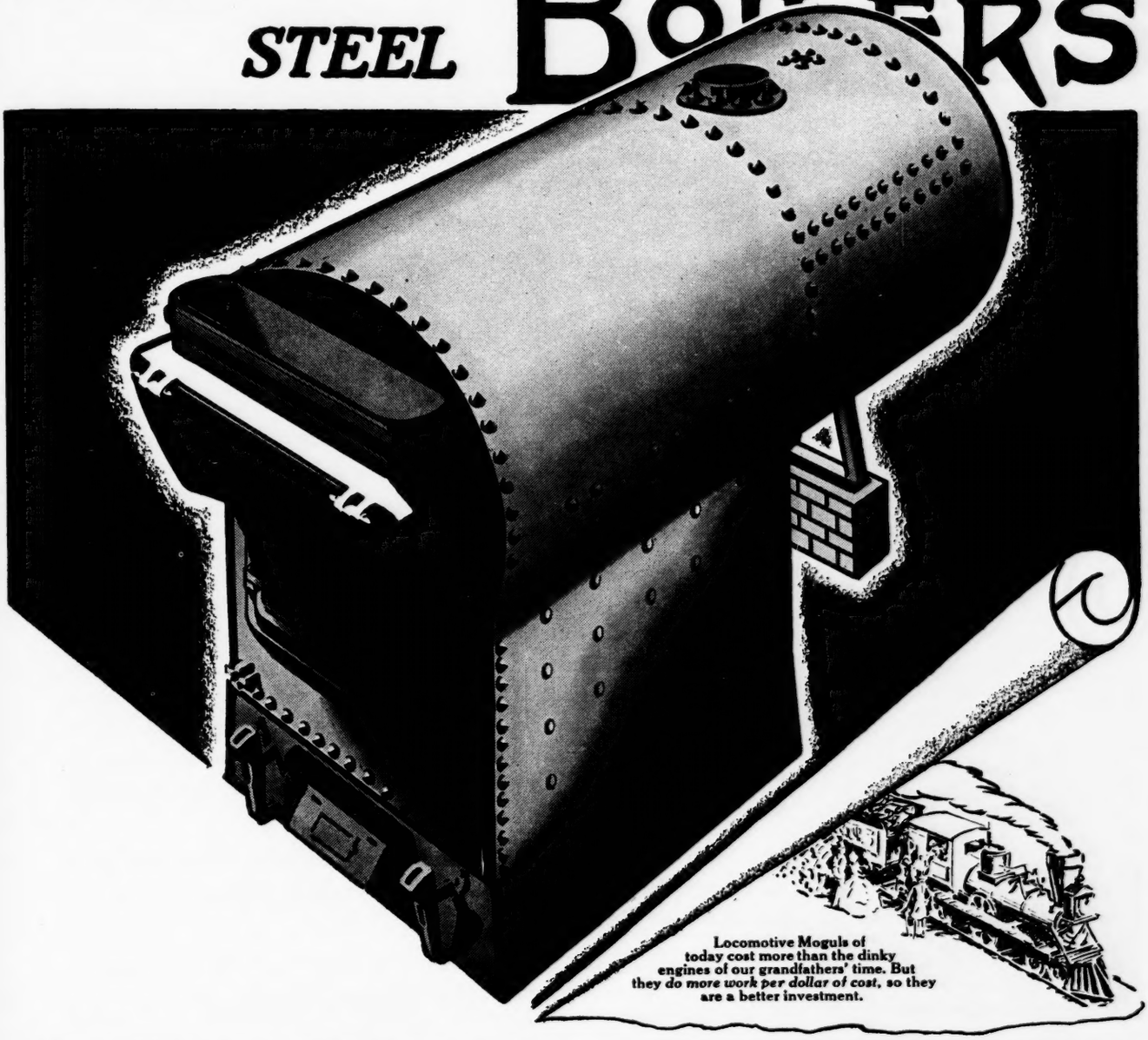
1. An all copper heating unit that greatly increases heat conductivity and resists corrosion.
2. Seamless copper tubes, welded into heavy copper headers provide equal expansion and contraction and eliminate chances of leaks that may occur when tubes and headers are of different metals.
3. After the heating element is welded together it is completely coated—inside and out—by immersion in a tin bath. This gives the tubes a glassy smoothness which prevents "clogging" and makes them immune from attacks by impure water.
4. The motor rests in a cork insulated saddle which absorbs all vibration, eliminating noise.
5. The heating element is suspended in its frame so that any contraction and expansion strains in the frame are not carried to the heating element—the source of most leakage troubles in some makes.

Try just one McQuay Unit in some "hard to heat" spot. Its heating ability will indicate the advisability of replacing old-time methods with the modern McQuay. Write for complete data, or ask our nearest branch—there's one in most cities.

McQUAY RADIATOR CORPORATION
General Offices: 35 East Wacker Drive, Chicago

McQUAY UNIT HEATERS

KEWANEE STEEL BOILERS



Locomotive Moguls of today cost more than the dinky engines of our grandfathers' time. But they *do more work per dollar of cost*, so they are a better investment.

Kewanee Boilers, with their riveted steel construction, are built "oversize" and "overstrength." They *also* are capable of doing more per dollar of cost.

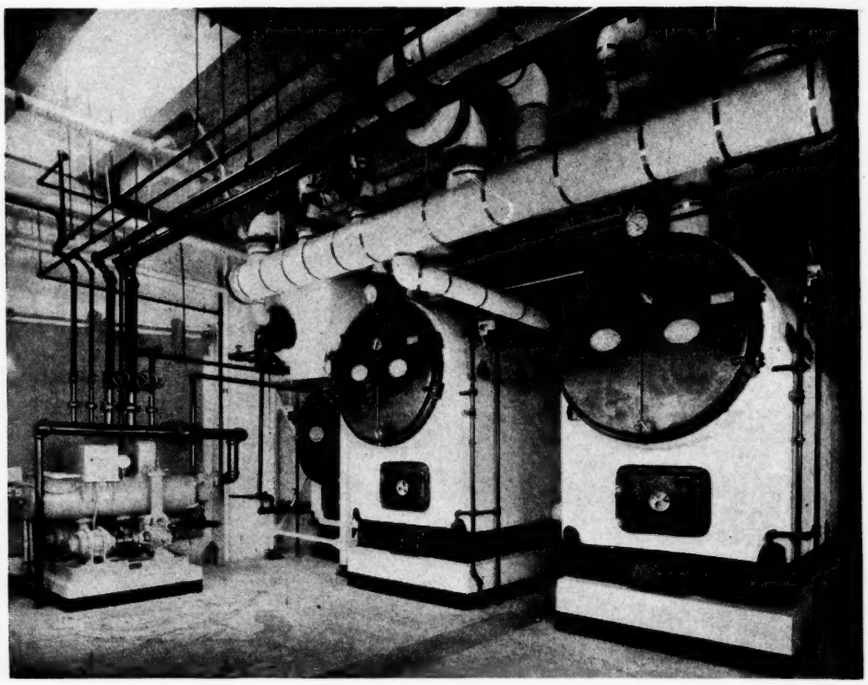
Then, too, the *extra years of life guaranteed* by their sturdy construction spreads their initial cost over many additional years.

KEWANEE BOILER CORPORATION
division of American Radiator & Standard Sanitary Corporation
KEWANEE, ILLINOIS

It Costs Less to OWN a KEWANEE

HEATING AND VENTILATING, *formerly* THE HEATING AND VENTILATING MAGAZINE, published by BUILDING DIVISION of NATIONAL TRADE JOURNALS, INC., at 521 Fifth Ave., New York, N. Y. Subscription rates: United States, $2.00; Canada, $2.50; Foreign, $3.00. Single Copies, 30 cents. Vol. XXVII, No. 6, June, 1930. Entered as second-class matter, April 18, 1925, at the Post-Office at New York, N. Y., under the Act of March 3, 1879. Copyright 1930, by NATIONAL TRADE JOURNALS, INC.

Fire Travel 4 *times the length of the boiler*



The Richfield Oil Company Building, outstanding new Los Angeles business structure, is heated by three Pacific Welded Steel Boilers burning oil. Architects, Morgan, Wells & Clements. Mechanical Engineer, Ralph E. Stevens. Heating Contractor, Thomas Haverty.

The Pacific Welded Steel Boiler oil fired heating installation in the Richfield building. This consists of one 5290 and two 15300 boilers. Pacifics can be used with any type of oil burning equipment. The change from coal to oil or vice-versa requires but a few hours' time.

THE Pacific Steel Boiler is uniquely designed for getting all the heating value out of oil.

The firebox runs the full length of the shell, giving the oil burning equipment plenty of space to completely atomize and properly burn the oil. When fired from the rear, the products of combustion must travel *twice the length of the boiler* before entering the tubes. The direct heating surface in the firebox is extra large; and yet tube heating surface is not sacrificed, for the hot gases must travel *twice the length of the boiler* in passing through the upper and lower banks of tubes. *The total fire travel is four times the length of the boiler.*

Even when front-fired, the fire travels three times the length of the boiler, once the length of the firebox and twice the length of the boiler in the tubes.

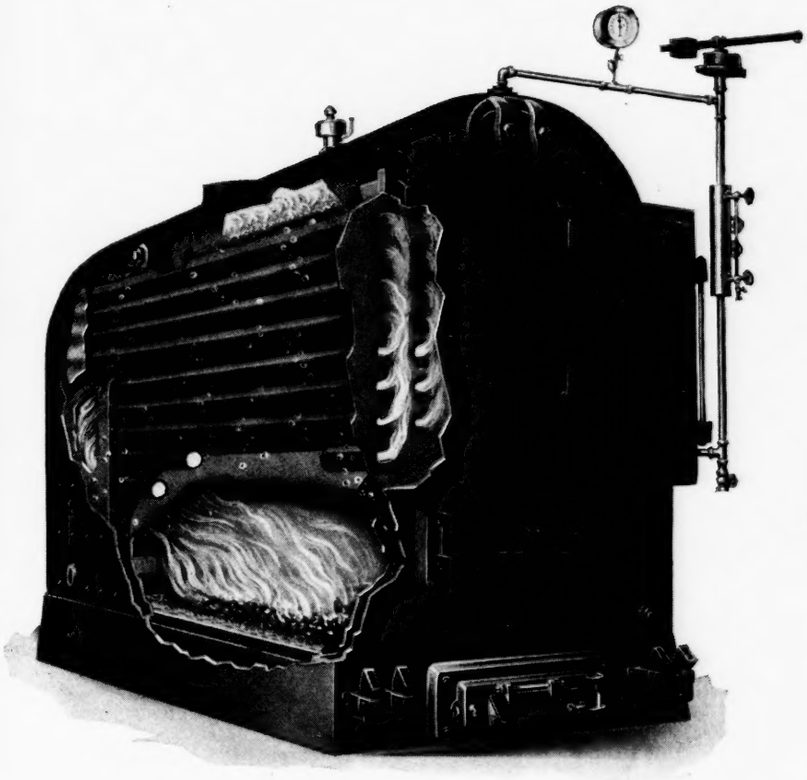
Burning oil, the Pacific reaches new levels of efficiency, just as it does when it burns hard or soft coal, coke, or gas.

THE PACIFIC STEEL BOILER CORPORATION
General Offices: Detroit, Michigan · Factories: Waukegan, Ill., Bristol, Pa.
Sales Offices in 58 Cities
Division of United States Radiator Corp., Detroit, Michigan

Steel Heating Boilers and Capitol Radiators make a logical combination.

PACIFIC
STEEL HEATING BOILERS

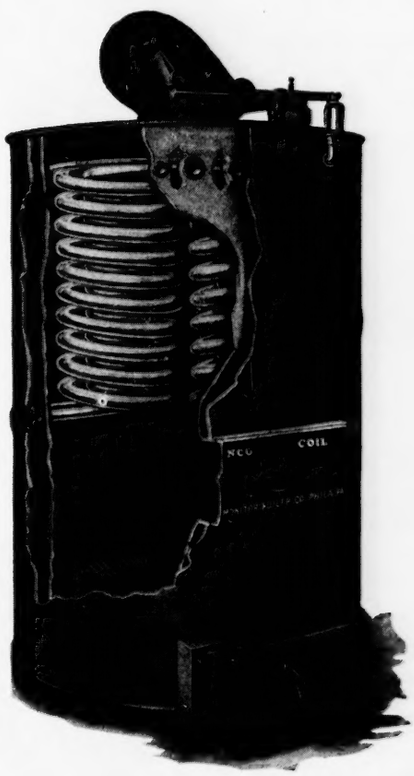
MONCO



STEEL HEATING BOILERS

for

COAL OR OIL BURNING



MONCO

COIL HEATING BOILERS

COIL WATER HEATERS

for

COAL OR OIL BURNING

MONITOR BOILER CO., 1505 Race St., Philadelphia, Pa.

Affiliated with UNITED DRY DOCKS, INC., NEW YORK

TESTED IN

Thermoflex TRAPS

Each Hydron bellows in Thermoflex steam traps is made by internal pressure, which tests its structure infallibly.

If there were the slightest weakness anywhere in its structure the bellows would be destroyed.

Do you know of any device which would be *ruptured and destroyed* while it was being made?

In the Thermoflex trap, the trap with the Hydron bellows, you have a guarantee of strength for each trap on each radiator far beyond any demands in actual use.

Thermoflex is a Hydron *Bellows* Trap

The heart of the Thermoflex trap is the Hydron bellows. This scientifically designed, tested-in-the-making trap is a *proved* trap. It will open and close the drain orifice millions of times a year with *no* signs of giving out. The Hydron bellows is in every Thermoflex radiator trap, drip trap, offset trap, and high pressure trap.

The one trap that meets Grinnell standards

Grinnell Company has discovered in Thermoflex the trap that meets its own exacting standards. It is a discovery of great importance because never before could a trap be pre-tested in its making.

The bellows type trap is the most practicable, the longest-lived trap.

Write for detailed information regarding Thermoflex Traps. Use the coupon on the opposite page.

Our Company will exhibit at the National Association of Master Plumbers', Forty-Eighth Annual Convention, at the Mechanics Building in Boston, Mass., from June 23rd through June 26th, in space No. 123.

Also certified under operating conditions

To guarantee reliability under operating pressure and temperature, each trap is tested and certified by an engineer of the Pittsburgh Testing Laboratory. He affixes a certificate tag to each trap which passes his test.

Certificate of Inspection

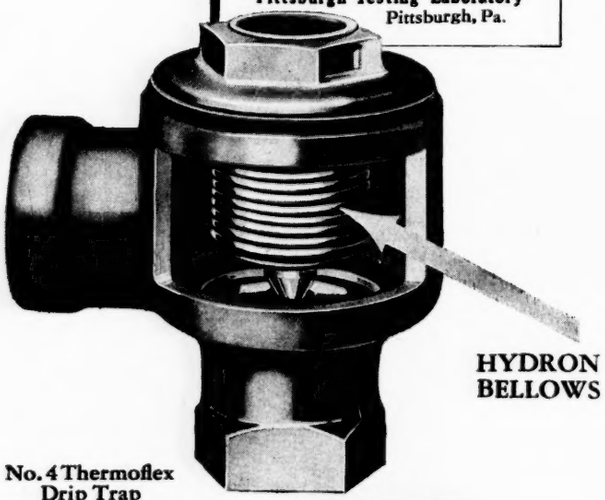
This is to Certify that this

Thermoflex

product has been individually inspected and tested by us, and that this tag is affixed by our engineer as denoting approval in accordance with test requirements outlined on the reverse side of this certificate.

PITTSBURGH TESTING LABORATORY · INSPECTION · TESTING · RESEARCH · ENGINEERS AND CHEMISTS

Pittsburgh Testing Laboratory
Pittsburgh, Pa.



HYDRON BELLOWS

No. 4 Thermoflex Drip Trap

For dripping mains, risers, coils and unit heaters, we offer this type of trap. Cast-iron body, bronze cap and inserted bronze seat, angle pattern only, without unions.

No. 3 Thermoflex Offset Radiator Trap

GRINNELL

Executive Offices: Providence, R. I.

THE MAKING

Grinnell Company is the exclusive distributor for Thermoflex traps. Years of unfailing service in all types of buildings and under severe and varied conditions have proved their unfailing value, their uniformly high quality, their long efficient service.

Let our sales engineers work with you to insure permanent satisfaction.

No. 100 Thermoflex High Pressure Trap
For pressures up to 125 pounds.

No. 12 Thermoflex Radiator Trap
Body is extra heavy throughout, using a brass forging for the cap and spudnut, highest grade cast brass for the body and spud.

COMPANY

Branches in all Principal Cities

GRINNELL COMPANY, INC.
276 W. Exchange St., Providence, R. I.

I want to read more facts about Thermoflex Traps. Send along your data booklet giving capacities and dimensions.

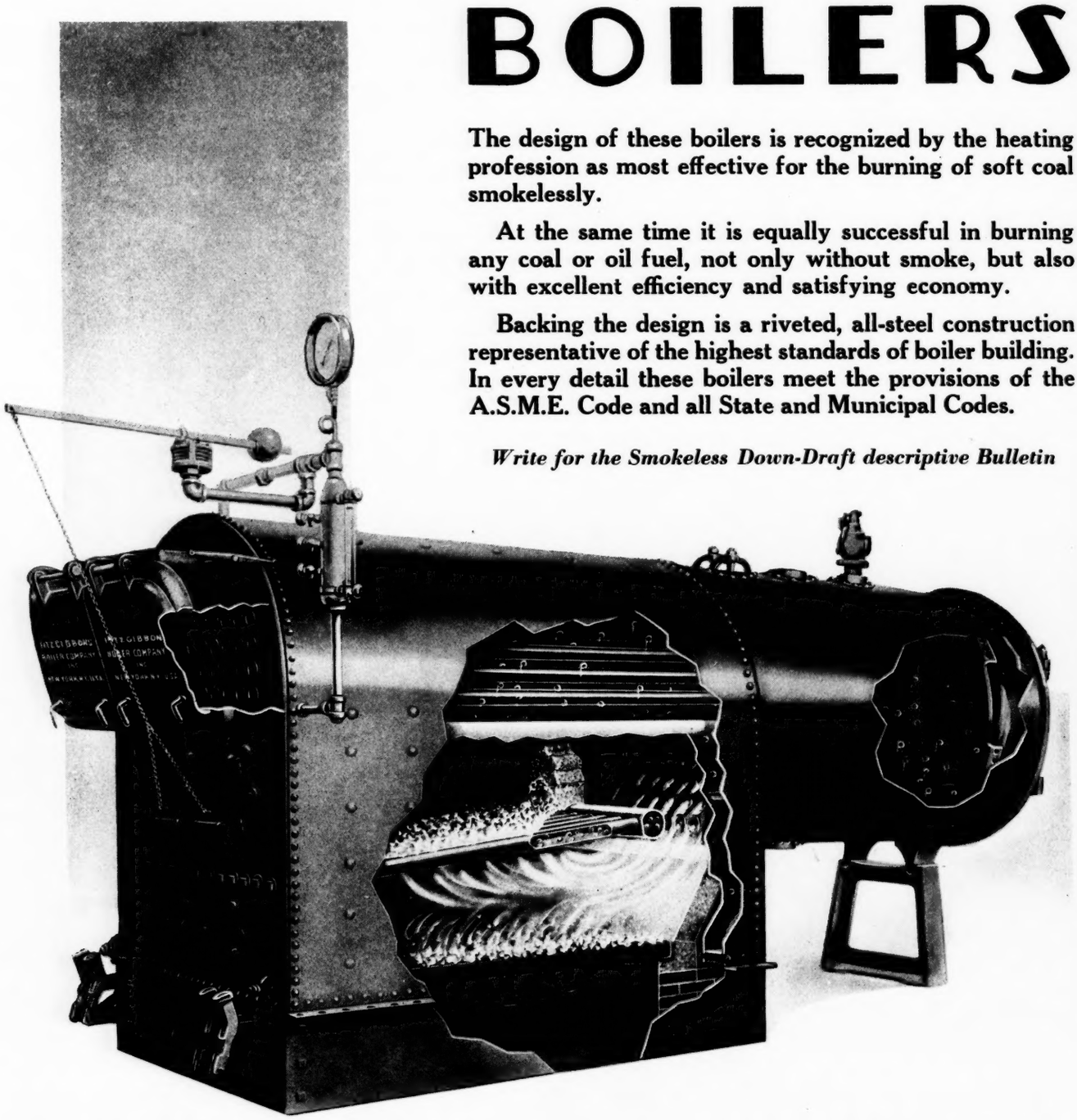
Name_____

Title_____

Firm Name_____

Address_____

FITZGIBBONS
Smokeless Down-Draft
BOILERS



The design of these boilers is recognized by the heating profession as most effective for the burning of soft coal smokelessly.

At the same time it is equally successful in burning any coal or oil fuel, not only without smoke, but also with excellent efficiency and satisfying economy.

Backing the design is a riveted, all-steel construction representative of the highest standards of boiler building. In every detail these boilers meet the provisions of the A.S.M.E. Code and all State and Municipal Codes.

Write for the Smokeless Down-Draft descriptive Bulletin

FITZGIBBONS BOILER CO., Inc.
General Offices: 574 Seventh Ave., New York, N. Y.
Works: Oswego, N. Y.

Branches and Representatives

Cleveland, Columbia, S. C., Columbus, Detroit, Grand Rapids, Pittsburgh, Raleigh, San Antonio, San Francisco

for Central, Southern and Western States

Sold by **KEWANEE BOILER CO., Inc.**
General Offices: 574 Seventh Ave., New York N. Y.

Sales Branches

Baltimore, Boston, Buffalo, Newark, New York, Philadelphia, Richmond, Syracuse, Washington

in New England and Middle Atlantic States, Virginia and District of Columbia

The Penn Thermostat

Simplifies UNIT HEATER INSTALLATIONS

RATINGS

Type A, charged metal bellows, for 1 H.P., single phase, A.C. and ½ H.P., direct current. Maximum voltage 250. Pilot service 550 volts.

Type AA, Thermostat for current loads up to 30 amperes A.C. non-inductive.

Type B, Bi-metallic metal, for 1/3 H.P. motor, either A.C. or D.C., maximum voltage 250. Pilot service 550 volts.

The Penn Thermostat for Unit Heaters was conceived and executed for the sole purpose of perfecting the performance of your unit heater. Simplification was the keynote of its creation. Through the use of the exclusive and patented Penn Magnet Structure, it has an enormous capacity to carry extremely heavy loads, without the use of relays, magnetic contactors, or transformers. It may be mounted in any convenient position, without affecting its original factory setting. The close differential assures uniform temperatures and economical operation..

The Penn Electric Switch Co. manufactures a complete line of automatic electric switches and other controlling devices for every type of heating system, including hot air, steam, water, and vapor. Each is listed as Standard by the Underwriters' Laboratories, and used as standard equipment by leading manufacturers.

Your own Unit Heater equipped with Penn Controls will have even greater salability, because it will be free from complicated hook-ups and fragile mercury tubes.

You will save on installation costs, and greatly reduce the number of service calls. There are three types of Penn Thermostats, Type A, AA, and B. We urge you to write for complete information and details on each individual thermostat. We will gladly furnish you a regular thermostat for test purposes.

PENN ELECTRIC SWITCH CO.

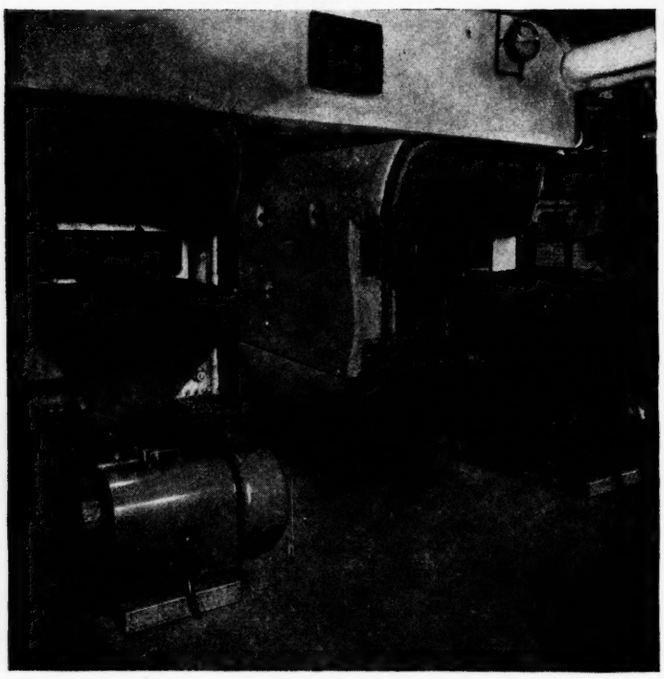
DES MOINES, IOWA

PENN

A COMPLETE LINE OF AUTOMATIC ELECTRIC SWITCHES FOR

OIL BURNERS UNIT HEATERS GAS AND ELECTRIC HEATERS PUMPS AND AIR COMPRESSORS

$1.80 a ton saved



Two Detroit Junior Stokers at Detroit Golf Club

THE MANAGEMENT OF DETROIT GOLF CLUB REPORTS:

"We have cut the cost of boiler room operation considerably with Detroit JUNIOR Stokers. We are now buying a cheaper coal and are saving $1.80 a ton on the delivered price. We also burn fully 20% less coal.

"As the stoker furnishes automatic heat with little attention we are able to dispense with one man in the boiler room. This saving alone amounts to $1,800 a year.

"Our stokers will easily pay for themselves in one year's time."

• *You, too, can save money with Detroit Stokers. A type and size for every service. For Detroit* JUNIOR *Stokers, ask for Bulletin 373* •

DETROIT STOKER COMPANY
Third Floor General Motors Building
DETROIT • MICHIGAN

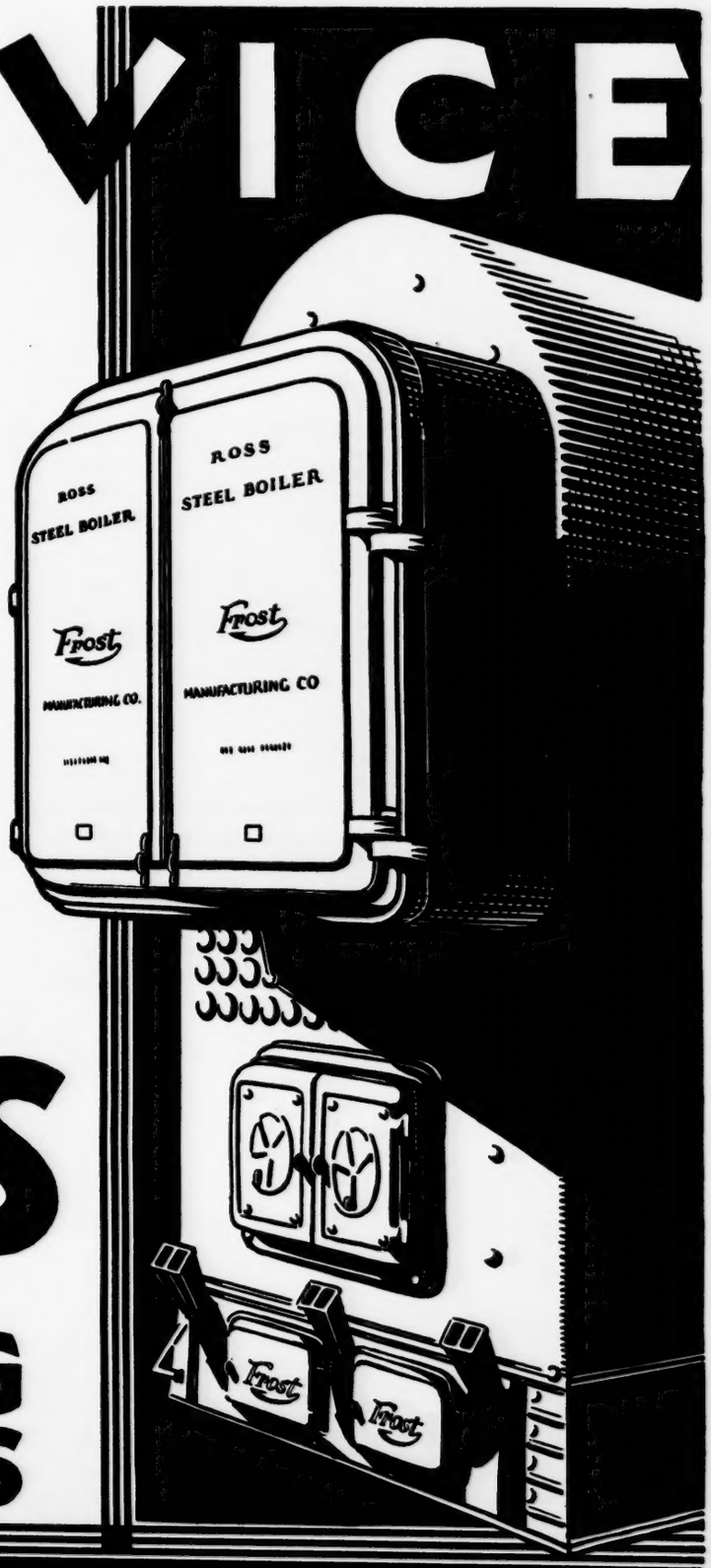
Detroit Golf Club

DETROIT JUNIOR STOKER

A TRIUMPH IN COMBUSTION ENGINEERING

SERVICE

Minimum installation expense, economical operation, and durable construction are deciding factors in present-day heating installations. ▾ ▾ ▾ ▾ ▾ These requirements are incorporated in



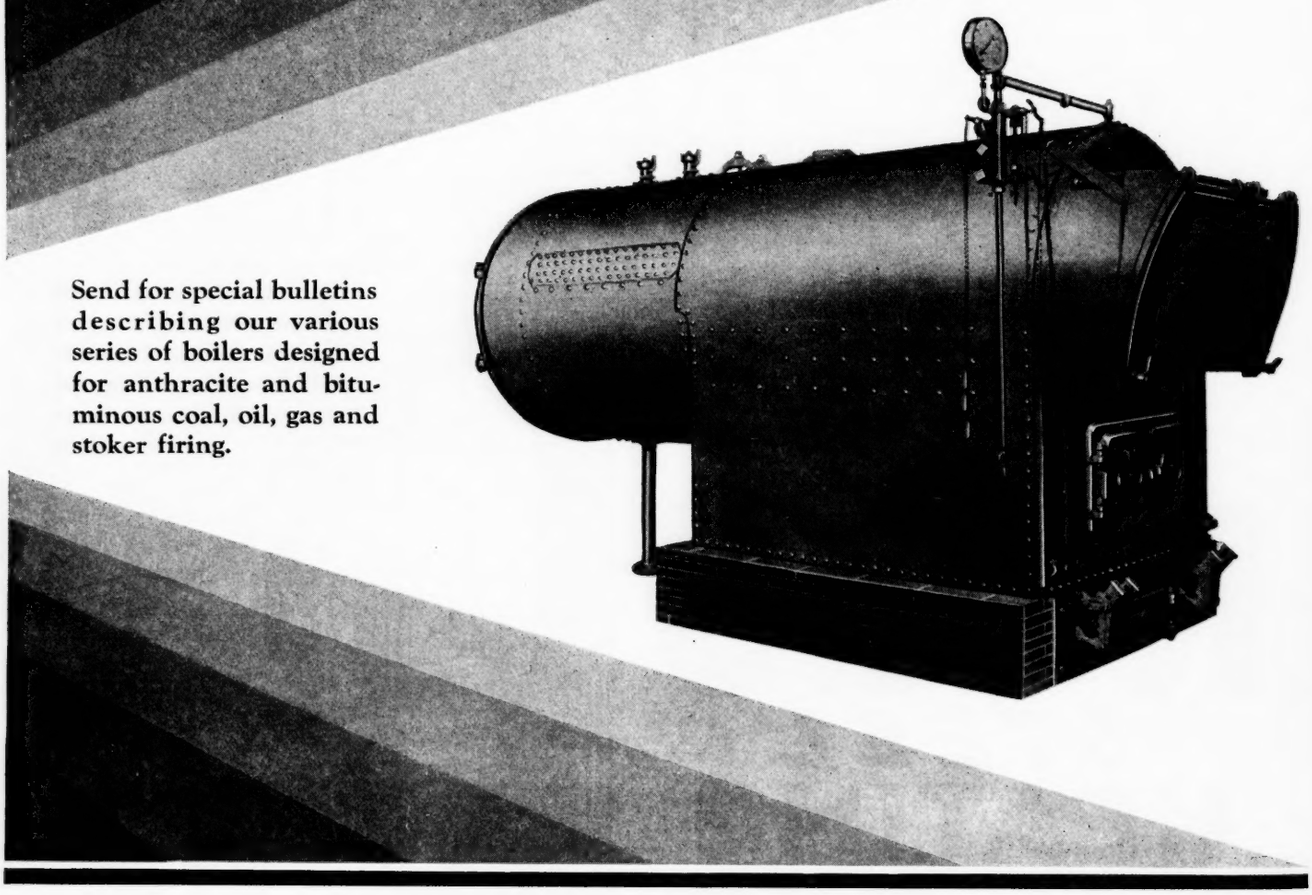
ROSS STEEL HEATING BOILERS

THE FROST MANUFACTURING CO.
GALESBURG, ILLINOIS
Established 1851

COATESVILLE BOILERS

COATESVILLE STEEL HEATING BOILERS

THEY ARE THE "ULTIMATE" OF CORRECT DESIGN
Known for Their Efficient and Economical Operation
Outstanding Because of a Proven Record of Durability



Send for special bulletins describing our various series of boilers designed for anthracite and bituminous coal, oil, gas and stoker firing.

COATESVILLE BOILER WORKS

Boilers - Tanks - Steel Plate Work

Main Office and Works—COATESVILLE, PA.

Philadelphia, 111 S. 15th St. | New York, 30 Church St. | Newark, 60 Park Place | Boston, 141 Milk St. | New London, 325 State St. | Pittsburgh, Union Trust Bldg.
Baltimore, Lexington Bldg. | Washington, D. C., 208 Evans Bldg. | Richmond, Va., Railway & Power Bldg.
Newport News, Va., 3100 Virginia Ave. | Bristol, Tenn.-Va., 607-609 State St. | Greensboro, N. C., North Carolina Bank Bldg. | New Orleans, 617 Common St.

Behind the scenes . . .

where unseen factors carry on

Imprisoned behind walls of brick, stone and mortar are the arteries of a modern building charged with an important responsibility.

Month in and month out, year after year they must serve without interruption. Only good dependable pipe like "Spang" Welded Pipe assures this long satisfactory service. Down through the years its record of service in many of the nation's finest buildings speaks for itself.

If you too, would specify quality in your plumbing pipe—specify "Spang"—it pays.

See our exhibit at the 48th Annual Convention of the National Ass'n of Master Plumbers in the Mechanics Building at Boston, June 23rd-26th.

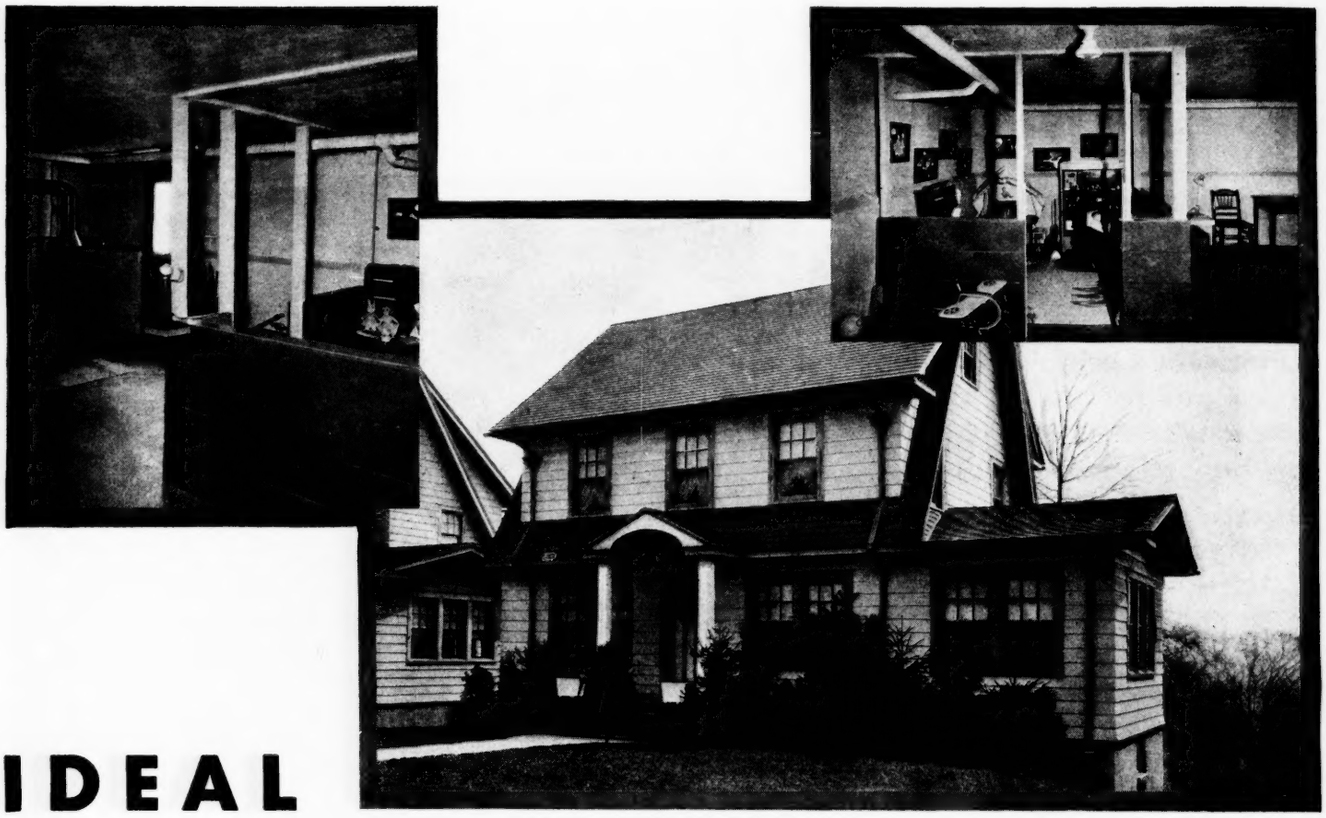
SPANG, CHALFANT & CO., INC.

General Offices: CLARK BUILDING, PITTSBURGH, PA.

Sales Offices: CHICAGO, ILL. NEW YORK, N. Y. ST. LOUIS, MO. PITTSBURGH, PA. TULSA, OKLA. LOS ANGELES, CAL.
Welded Mills: ETNA, PENNA. SHARPSBURG, PENNA. Seamless Mills: AMBRIDGE, PENNA.

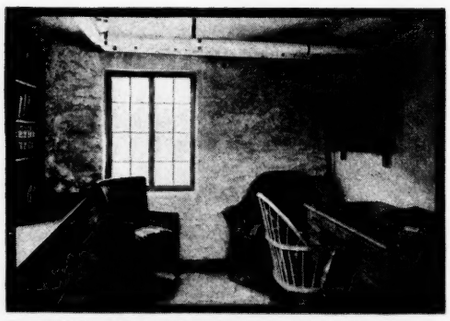
SPANG

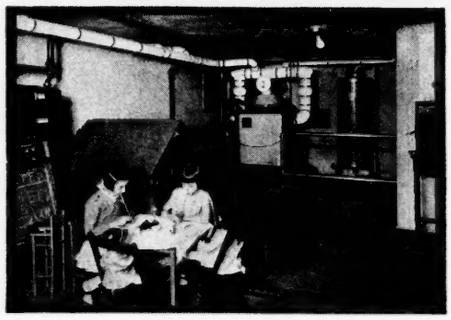
WELDED STEEL PIPE



IDEAL GAS BOILERS

give owners basements like these . .





● Homes can be really modernized when Ideal Gas Boilers are installed. The basement can be turned into additional living quarters that are clean and comfortable. The illustrations on this page will give you some idea of how owners are transforming their basements with the help of Ideal Gas Boilers.

● Ideal Gas Boilers burn noiselessly, cleanly, efficiently and automatically. They require no fuel storage or handling. The fuel comes from the same inconspicuous pipe as the fuel for the gas range. They require no ash removal. The fuel is entirely consumed without soot or dirt.

● These features which insure healthful even temperature throughout the house—with luxurious freedom from care—which give livable additional space for den, workshop or playroom, appeal to every home owner who is planning to modernize and to everyone who is planning to build or buy.

● We'll be glad to tell you more about this modern equipment if you will write us.

Manufactured by

AMERICAN RADIATOR COMPANY

Distributed by

AMERICAN GAS PRODUCTS CORPORATION

CHRYSLER BUILDING, NEW YORK

Hundreds of WHITING STOKERS are giving Service like this

ST. JOSEPH SANITARIUM
ONE EIGHT TWO ONE MILES AVENUE
ST. JOSEPH, MICHIGAN

February 6, 1930

Joseph Harrington Company
Harvey, Illinois

Gentlemen:-

We are very much pleased with the Stoker and with the service which you have rendered us. While it is too early in the season to have definite figures, we are very sure that our total coal consumption will be increased approximately 30%. We have heated 25% more space, and have used coal costing approximately 15% less. Therefore, we have a definite saving. The elimination of a night janitor's services saves us approximately $700.00 per year, so that our total saving is very satisfactory.

Were the expense exactly that of previous years, we would still be very much pleased with the Stoker because of the uniform heat and freedom from smoke.

It has never been our pleasure to receive such cooperation as you have extended to us, and we wish to especially thank you for this.

We feel sure that this cooperation came thru your office, and we hope you will permit us to thank you personally.

Very truly yours,
ST. JOSEPH SANITARIUM
T. G. Yeomans
Secy-Treas.

TGY/m

Whiting Model C Low Set Stoker (Patented) under Illinois Malleable Cast Iron Boiler; St. Joseph Sanitarium, St. Joseph, Michigan

Performance follows correct design

The savings and satisfaction provided by the Whiting Stoker (formerly the King Coal) are due largely to the fact that it is designed correctly and expressly for small boilers.

The horizontal feed mechanism of the Whiting Stoker provides an even fuel bed, under positive control at all times. Combustion is progressive with a clean, bright fire, free from clinkers. Ash is continuously and automatically discharged as formed.

The Whiting Stoker burns the cheapest sizes of coal smokelessly and efficiently—effecting savings which make the installation a profitable investment. Automatic operation reduces boiler room labor to a minimum. Boiler capacity is substantially increased. Adaptable to any standard boiler, 25 to 250 H. P.

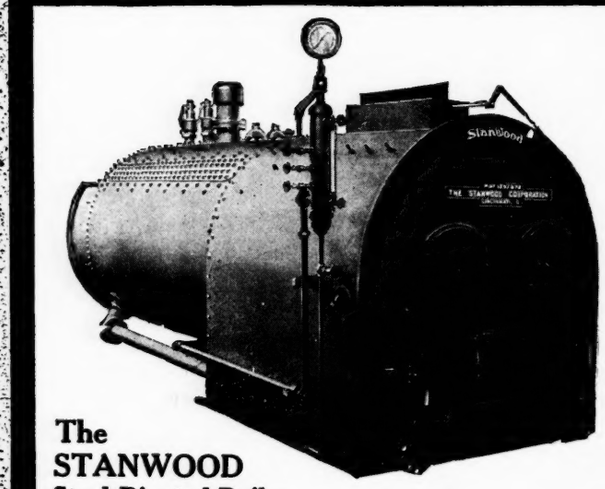
Whiting Stokers installed in your plant, will save you money—how much depends on your conditions. Without obligation our engineers will be glad to tell you what can be done. Write for literature and tell us the size and type of your boilers.

Joseph Harrington Co., Subsidiary
WHITING CORPORATION
15695 Lathrop Ave., Harvey (Chicago Suburb) Illinois

WHITING STOKER

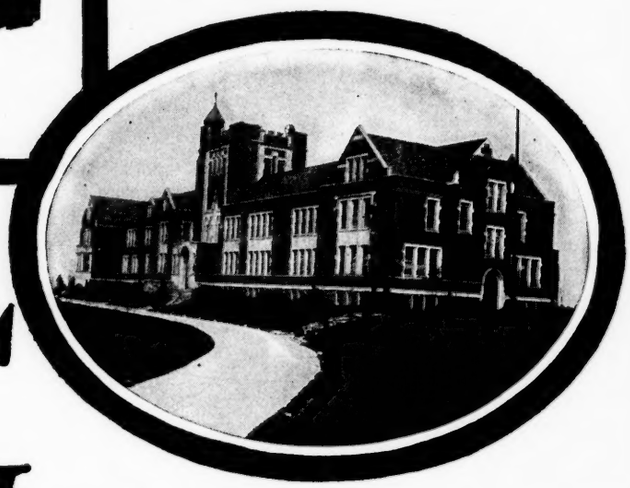
Joseph Harrington, Engineer

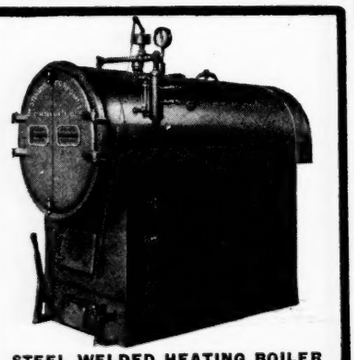
"Almost Sure" may be WRONG!



The STANWOOD
Steel Riveted Boiler
Built for 15 to 150 lbs. pressure. Larger if desired.

The building pictured below (Sisters of Notre Dame, St. Joseph's Heights, Covington, Ky.) is equipped with three Stanwood Steel Riveted Smokeless Boilers—Two No. 614 and one No. 710.





STEEL WELDED HEATING BOILER
Smokeless or Direct Draft type. Compact, requires minimum space. All seams and joints electrically welded into one solid leak proof unit for 15 lbs. pressure.

GUESSING or being "almost sure" sometimes is very much wrong! One bad guess will eat up the profits of modern building administration. A "miss" may mean an unpleasant and embarrassing explanation to a disgruntled client.

In so important a specification as a boiler, correct selection of the heating equipment is imperative—for if it's wrong—the entire building is wrong.

Stanwood Boilers meet every heating requirement. Available in three types (The Welded, The Riveted, and The HRT)—there is one for every job—whether it is small or large. Each Stanwood Boiler contains certain exclusive characteristics that make it particularly desirable and applicable for the job. A word from you will bring complete information, just specify the size of boiler needed.

THE

When writing for information ask for Bulletin 100, Welded Boiler; Bulletin 500, Steel Riveted Smokeless Boiler; Bulletin 517, Horizontal Return Tubular Boiler with Bag Type Steel Casing.

STANWOOD
CORPORATION

Est. 1891 Dept. D-630 Cincinnati, Ohio

The Modern Boiler Insulation

INVESTIGATE *Gimco* ROCK WOOL *the* MODERN BOILER INSULATION

Gimco Rock Wool Flexfelt for boiler covering is Rock Wool fabricated between galvanized netting or metal lath either rigid or flexible, in standard shapes or cut to fit with or without a base for plastering.

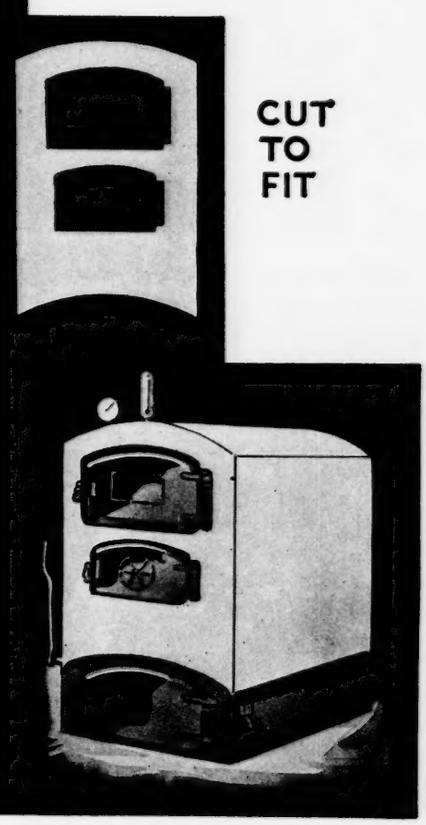
Merits of Flexfelt

1. **Average conductivity .27 B.T.U.'s. Highly efficient up to 1250° F.**
2. **Being made from a silicate rock, it does not deteriorate, but will maintain its original efficiency for the life of the boiler.**
3. **Will not sour, smoke or give off an odor.**
4. **Absolutely no breakage in handling. Material can be removed and replaced without loss.**

Other Rock Wool Products:

Pipe Covering, Insulating Cements
Bulk Rock Wool Granulated Rock Wool

We specialize in quality Rock Wool products.



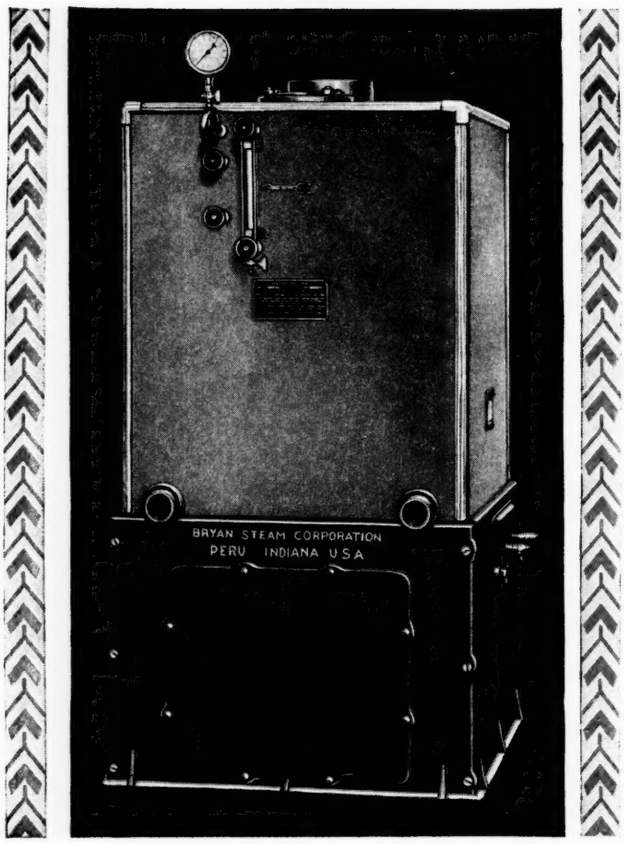
CUT TO FIT

GENERAL INSULATING & MFG. CO.

ALEXANDRIA, INDIANA

Brooklyn Chicago Hollywood Birmingham Cleveland San Francisco Houston Detroit St. Louis Pittsburgh Denver Toronto

OIL BURNERS DEMAND A SPECIALIZED BOILER



RIGHT: *Contrast this maze of copper-tubes through which every heat unit must pass in the Bryan Boiler, with the bulky, heavy cast-iron sections of the conventional coal-burning type of boiler. With Bryan there is no "laning" or stratification of the hot gases. The heat is broken up, time after time, by rushing head-on into the copper-tubes, which are capable of absorbing and transmitting heat nearly eight times as fast as a cast-iron section of equal size.*

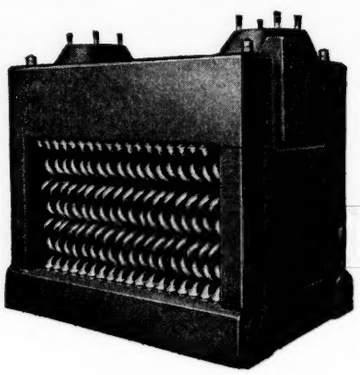
OIL-HEAT is sudden and intense, reaching its peak temperature almost the instant the burner is ignited . . . There is no period of gradually increasing temperatures, and gradual heat absorption, as with a coal fire.

To work efficiently and economically with an oil-burner—to prevent *waste* of the heat so quickly generated—a boiler must be able to *absorb* this heat as fast as it is produced.

Bryan has designed a boiler which does this—largely through the use of copper tubes which are capable of absorbing heat nearly eight times as fast as cast iron—and through an entirely new principle of construction which increases water circulation proportionately. All heat generated is absorbed and transmitted almost instantly, with a maximum of efficiency. In actual service, Bryan Copper-Tube Boilers consistently show a fuel saving of 30 percent to 50 percent over other types.

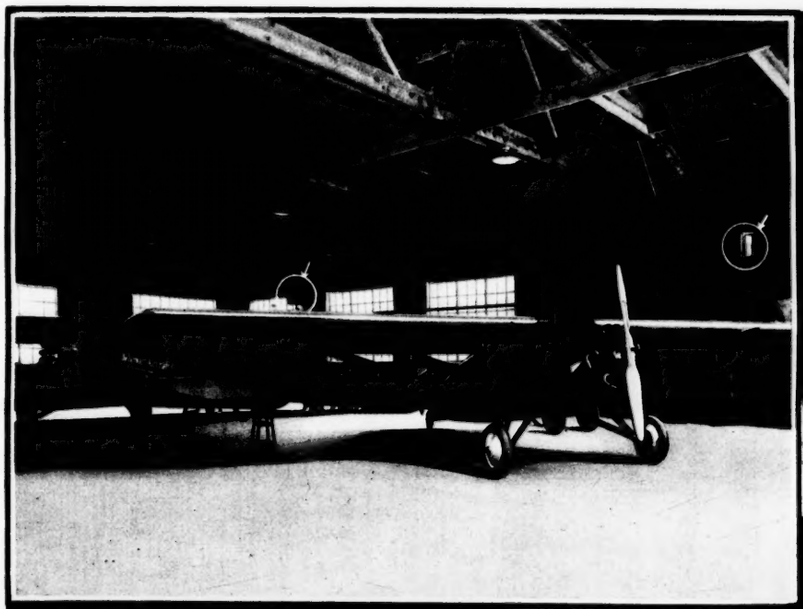
The Bryan Copper-Tube Boiler has little in common with other boilers. It was designed from the outset to take advantage of the combustion characteristics peculiar to oil and gas—and to do this it was found necessary to depart completely from conventional coal burning boiler design.

The complete story of the Bryan Copper-Tube Boiler, together with complete technical data, is contained in the Bryan Catalog, recently issued. We shall be glad to forward you this catalog, if you will write.



BRYAN STEAM CORPORATION
(Boiler Division)
PERU, INDIANA

BRYAN Copper-Tube BOILERS



HERE was the problem:

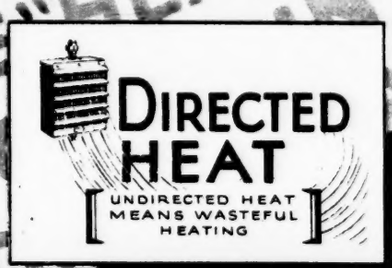
How to heat the airplane hangar with doors 30 to 60 ft. wide being opened frequently.

The answer: Modine Unit Heaters.

In the Stewart Aircraft Corporation hangar above two Units are suspended to face the doors and throw a "heat curtain" to smother cold air that naturally flows in with the opening of the wide doors. On severe days comfortable temperatures are maintained.

What discomfort—what expense old methods of heating would mean to this new industry.

Are old methods causing discomfort and needless expense in your plants? Get complete facts about Modine Unit Heaters before you answer this question. Write today.



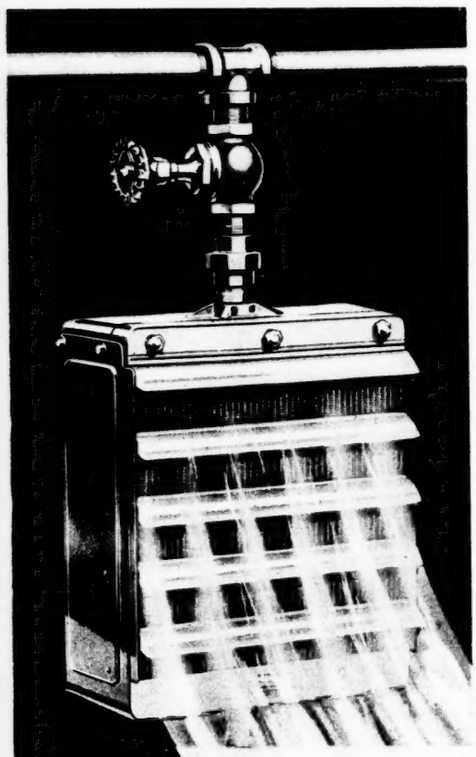
MODINE MANUFACTURING COMPANY

Manufacturers of Unit Heaters
Domestic Copper Radiation » Automotive Radiators
1700 Racine St. (DEPT. D) Racine, Wis.
Branch offices in all large cities
London Office « S. G. Leach & Co., Ltd. » 26-30 Artillery Lane

Modine
Unit HEATER

A MODINE Product

© 1930, Modine Mfg., Co.



ECONOMY of Maintenance

MODINE Unit Heaters lower the "heat ceiling." They are installed from the over head steamline 10 to 14 ft. above the floor level, deliver heat down over a wide floor area and keep it down. The waste of heat banked at the ceiling, as with old methods, is eliminated.

The quick heating and instantaneous and individual control of Modines are equally important economy factors.

The morning warming up period is materially shortened. On the colder sides of the building only the required Units are continued in operation. With heat instantly available at the turn of an electric switch, the tendency of employees to waste heat is eliminated.

The "full-floating" assembly of the Modine condenser insures a lifetime of trouble-free heating. There is no weight of frame or fan motor on the copper heating element. Proper allowance is made for expansion with heating. Outside strain is eliminated. The "full-floating" Condenser is one of the original exclusive Modine features.

Economy plus better heating make Modines the ideal equipment for your industrial heating. Write for complete information today.

MODINE MANUFACTURING COMPANY

Manufacturers of Automotive Radiators
Unit Heaters « Domestic Copper Radiation

1700 Racine St. (DEPT. D) Racine, Wis.

Branch offices in all large cities

London Office « S. G. Leach & Co., Ltd. » 26-30 Artillery Lane

Modine Unit HEATER

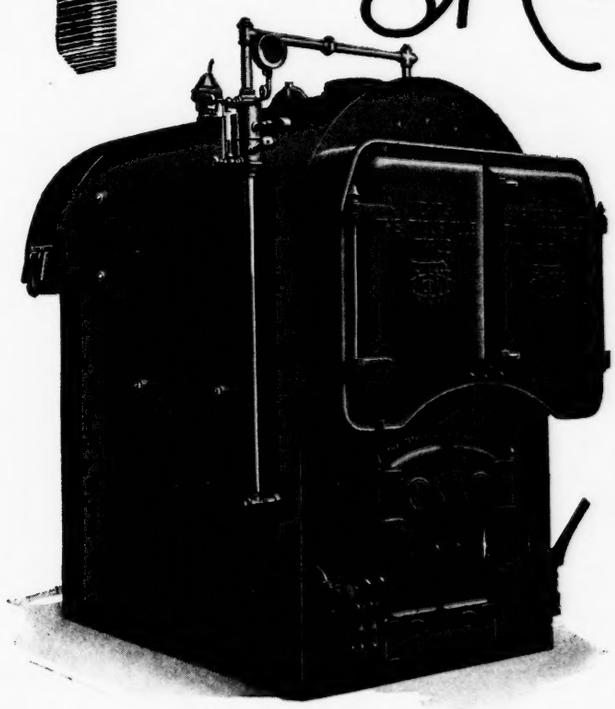
A MODINE Product

The Boiler for your Client's Building is the one you'd choose for your own.

There's "time" that goes "up the stack" too!

Boilers burn two kinds of fuel. One is the engineer's time. Some regular upkeep is necessary, but every extra hour it takes to keep a boiler in service is time that goes "up the stack"—time that's wasted. You want a boiler built to conserve time.

TITUSVILLE "SR" Welded Boilers



cost least in the long run because they burn up less of an engineer's time. The regular maintenance is made easier. There are wide openings through which to get at things. The boiler is *designed* for easy upkeep. And the likelihood of needing out-of-the-ordinary repairs is very small. That, too, is a function of far-seeing design. Titusville Boilers are boilers you'd like to own if you, yourself, were operating buildings.

Investigate these easy-upkeep Titusville Boilers. Ask us to send the new bulletins.

THE TITUSVILLE
IRON WORKS COMPANY
Division of Struthers Wells-Titusville Corporation
TITUSVILLE, PA.
Branch Sales Offices in all Principal Cities

TIW-48

Chicago Civic Opera Building is also ventilated by "Buffalo"

This beautiful new structure was recently dedicated to the lovers of opera. Money was no object in making it one of the finest buildings of its kind in the World.

The equipment installed was selected after considerable consideration; only the very best being finally chosen. That explains why Buffalo ventilating units were installed.

Better Buildings—Better Fans—Buffalo Fans.

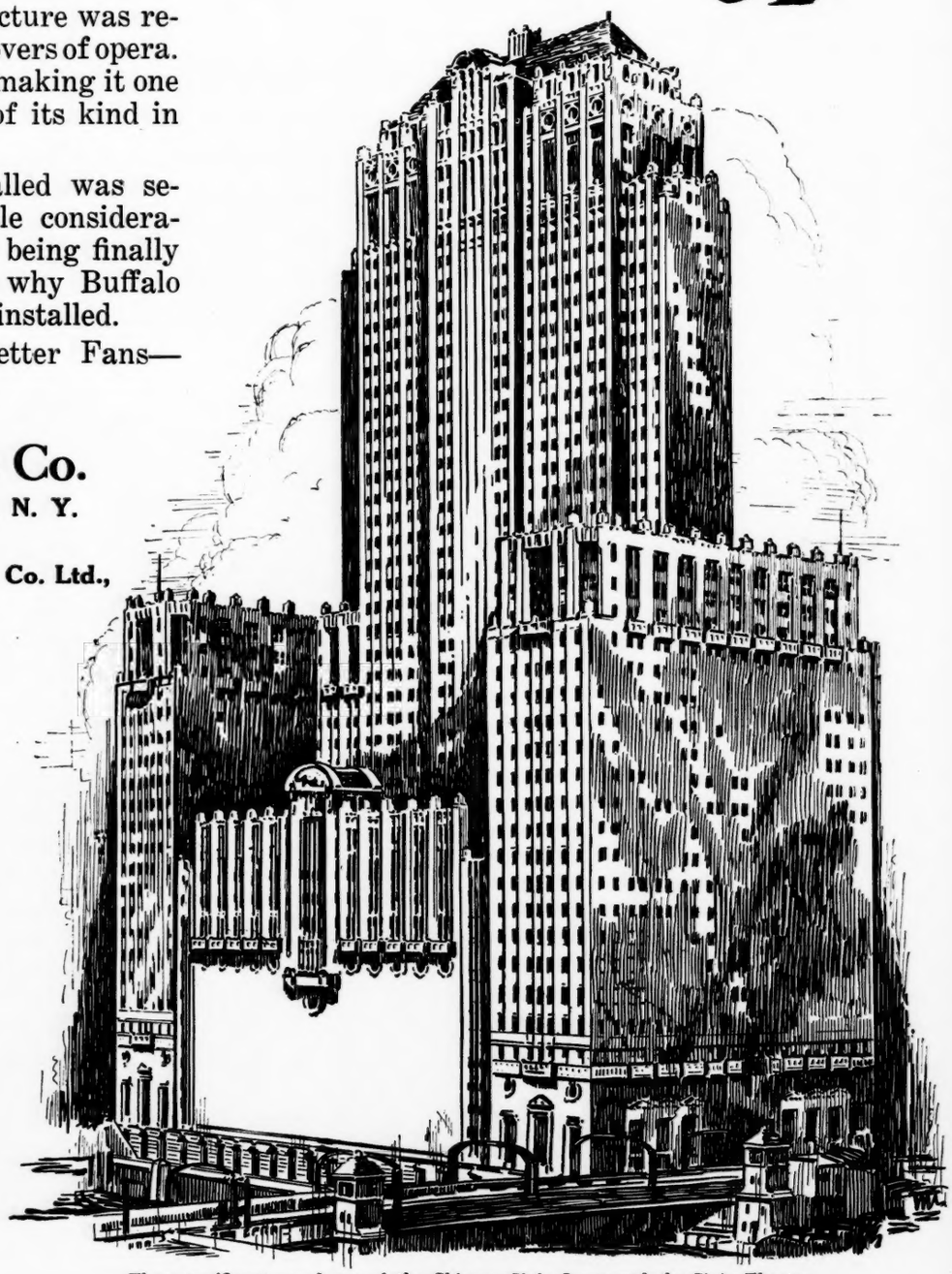
Buffalo Forge Co.
480 Broadway, Buffalo, N. Y.

In Canada:
Canadian Blower & Forge Co. Ltd., Kitchener, Ont.

Architects—
Graham, Anderson
Probst and White

General Builders—
John Griffiths and Son Co.

Heating Contractors—
Wolff Bros.
Kinzie Engineering Co.



The magnificent new home of the Chicago Civic Opera and the Civic Theatre

"Buffalo" for Heating, Ventilating, and Air Conditioning

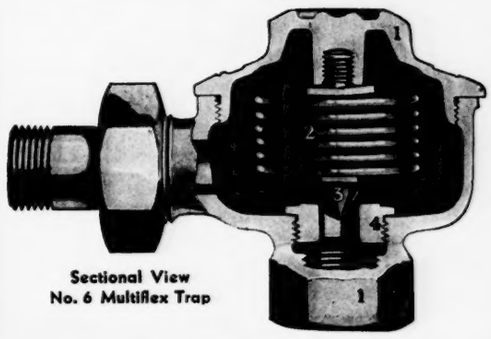
IN THREE OF NEW YO
NEW SKYSCRAPERS

NO higher tribute could be paid to the efficiency of Bishop & Babcock Bellows-type Radiator Traps and Bellows-type Modulation Valves than that they were chosen last year by three of the country's largest buyers.

All of the seamless Multiflex bellows forming the operative member, as well as all other parts of these traps and valves are made complete in the plants of The Bishop & Babcock Manufacturing Company. Their inherently correct design, combined with careful fabrication and thorough testing insure perfect performance.

The B & B line includes Vacuum and Vapor low-pressure Heating Specialties; Automatic Temperature and Humidity Control; and Massachusetts Fans, Air Washers and Unit Heaters. It will pay you to standardize on these products because of their uniformly correct design and satisfactory operation.

THE BISHOP & BABCOCK SALES CO.
General Offices, Cleveland, Ohio Offices in Principal Cities



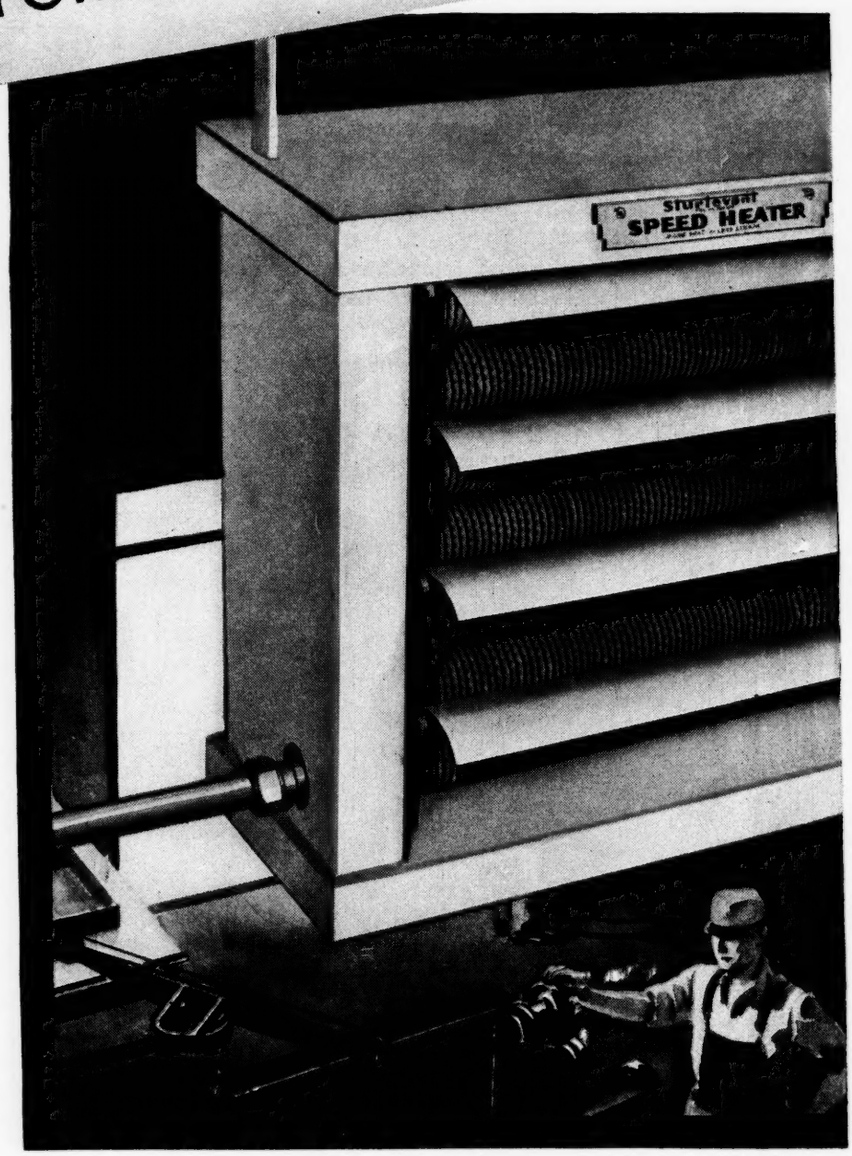
Sectional View
No. 6 Multiflex Trap

Sectional View of
Special Multiflex
Modulation Valve

BISHOP & BABCOCK

TEMPERATURE REGULATION
HEATING SPECIALTIES VENTILATING EQUIPMENT

THESE SPEED HEATER FACTS SPEAK FOR THEMSELVES!



SPEED HEATERS have won the endorsement of architects, engineers, contractors and users. Since their introduction...thousands have been installed!

Check the Speed Heater Facts below. They will give you the Speed Heater story in a nutshell.

1. Heating Element:—*High Pressure* Aerofin, for pressures up to 350 lbs.
2. Fans:—specially designed for Speed Heater service.
3. Exceptionally quiet operation:—due to good engineering.
4. Strap Hangers:—furnished with every Speed Heater. Make hanging a quick, easy job.
5. Vertical Louvres:—an innovation, exclusive with Speed Heaters. Spread air flow over wider area. Use is optional.
6. Prices:—exceptionally low . . . because of quantity production.

SHIPMENT FROM STOCK

7. Speed Heaters for all standard voltages, A. C. and D. C., are carried in stock at conveniently located storage points throughout the country. On-the-dot shipment is assured!

Have you complete data on Speed Heaters? The coupon is handy...send it now!

B. F. STURTEVANT CO.

Hyde Park, Boston, Mass. Branch Offices in Principal Cities. *Canadian Offices at:* Toronto, Montreal and Galt. *Canadian Representative:* Kipp Kelly Ltd., Winnipeg. Also Agents in Principal Foreign Countries

---COUPON---

B. F. STURTEVANT CO., Hyde Park, Boston, Mass.

Kindly send me a copy of the SPEED HEATER DATA BOOK.

☐ Check here . . . and one of our men will call.

*Company*_____

*Street*_____

*City*_____ H.V. 6-30

Sturtevant
(REG. U. S. PAT. OFF.)
SPEED HEATERS

EVIDENCE
OF LEADERSHIP

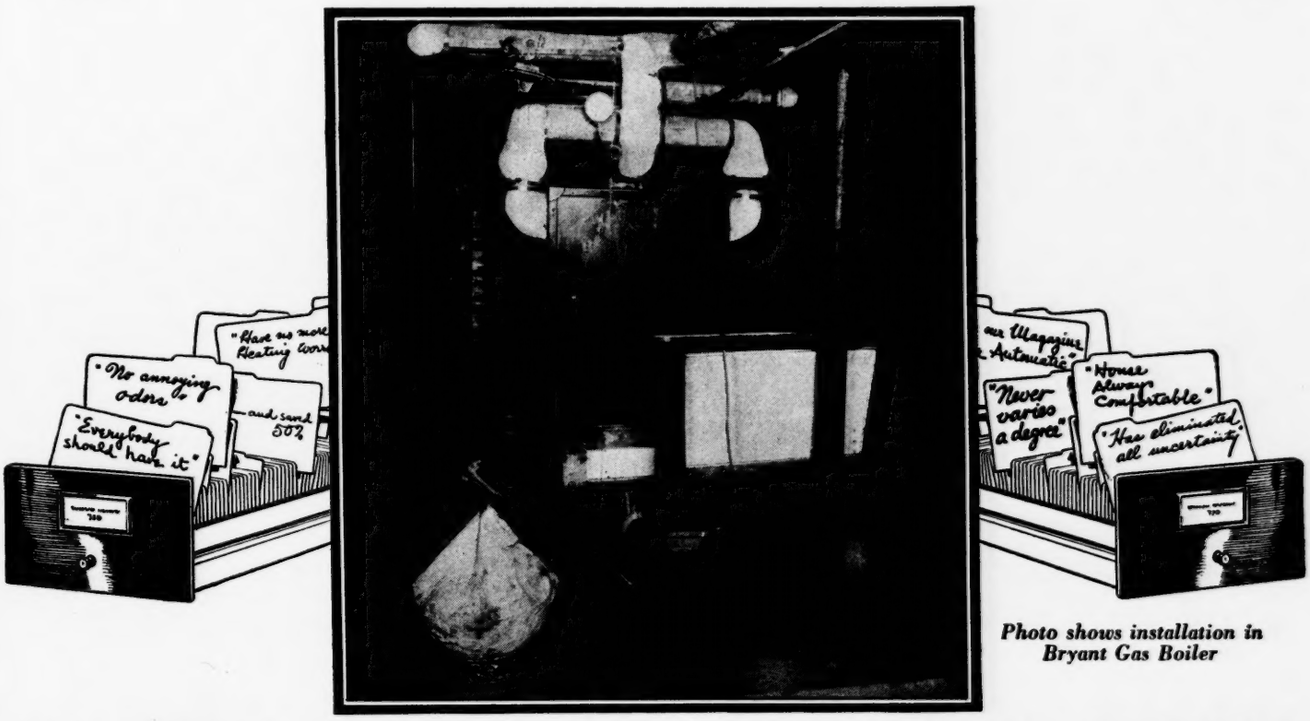


Photo shows installation in Bryant Gas Boiler

IN THE DOMESTIC HEATING FIELD

MODERNIZE the heating plant—give your customers uniform, healthful heat at all times — with labor-saving convenience—safety — dependability—cleanliness—and economy.

Here is the one modern automatic device—burning Pennsylvania Anthracite — the one safe, dependable and economical household fuel—which gives *all your customers* complete satisfaction with the utmost obtainable efficiency—*and savings up to 80%*.

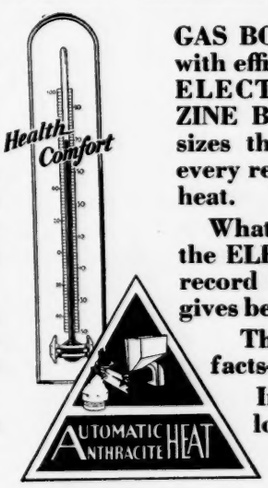
The ELECTRIC FURNACE-MAN can be easily installed in any hot water, vapor, steam or warm air system. It is ideal also for hot water supply.

The ELECTRIC FURNACE-MAN converts GAS BOILERS and OIL BURNER BOILERS with efficiency and economy of operation. The ELECTRIC FURNACE-MAN makes MAGAZINE BOILERS automatic. In homes of all sizes the ELECTRIC FURNACE-MAN meets every requirement of modern automatic home heat.

Whatever the present method of heating, the ELECTRIC FURNACE-MAN proves by its record in more than 10,000 homes that it gives better heating satisfaction at a lower cost.

This is the evidence of leadership. Service facts—not theories.

Investigate. See a demonstration at local dealers.



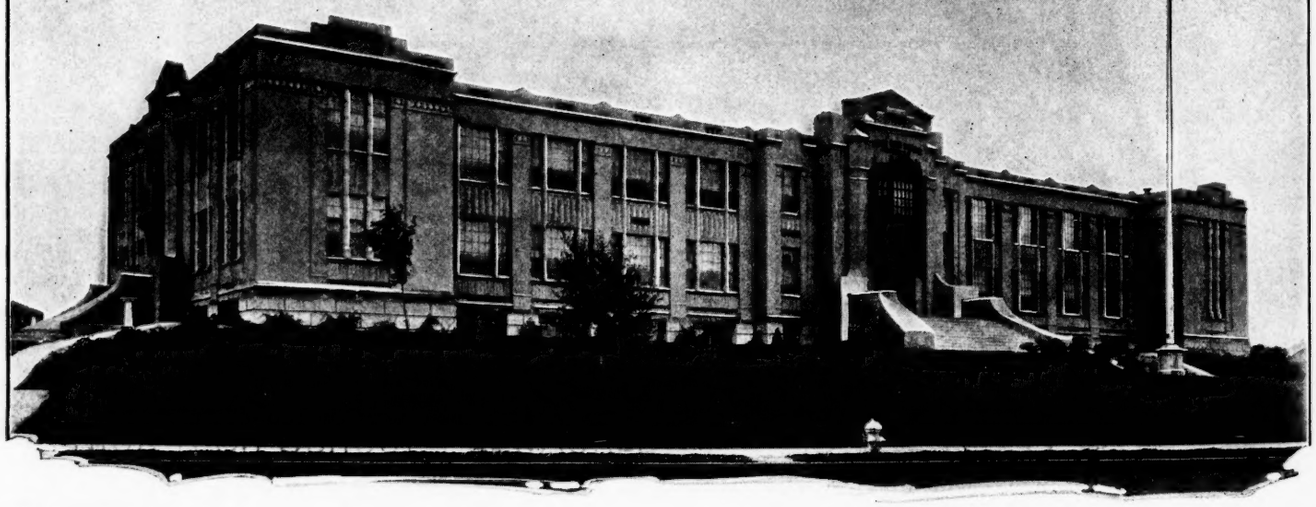
The Electric Furnace-Man

(Patented Automatic Coal Burner)

ENDORSED BY ANTHRACITE OPERATORS CONFERENCE — A BILLION DOLLAR INDUSTRY
AUTHORIZED DISTRIBUTORS AND DEALERS IN OVER 325 CITIES

DOMESTIC STOKER COMPANY, 7 DEY STREET, NEW YORK

Do you know the fine points of the PEERVENT Unit?



Union High School, Milwaukee, Ore., equipped with
16 PEERVENT UNITS

F. M. Stokes, Architect
Hastorf-Lord Co., Heating Contractors

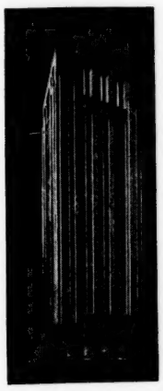
MAKE it a point to visit some of the schools where PeerVent Units are in use and see for yourself how quietly and efficiently these units operate under varying conditions—It will be a revelation to you—Also, remove the front panel from one of these units and look inside—see the new PeerFin Radiator—the silent-running motor—the air filter—the mixing damper. Then you will realize that PeerVent Units are more than mechanical equipment.

PeerVent Units have a proven durability. Units built and installed 18 years ago are still in use and operating satisfactorily.

Based on correct ventilation principles, PeerVent Units insure a more even temperature than ordinary types of heating systems. When properly installed with correctly located air inlets, PeerVent Units will keep the floor temperature in the schoolroom within 2 degrees of the temperature at the breathing line. With ordinary heating systems this temperature variation is often as much as 10 degrees. PeerVent Units are economical. As each unit is independent from those in other rooms, only the units in occupied rooms need be operated.

Please write if you would like to talk to our local resident engineer. You will be under no obligation.

PEERLESS UNIT VENTILATION CO., Inc.
BRIDGEPORT, CONNECTICUT
Pioneers in Unit Ventilation
Resident Engineers in Principal Cities from Coast to Coast



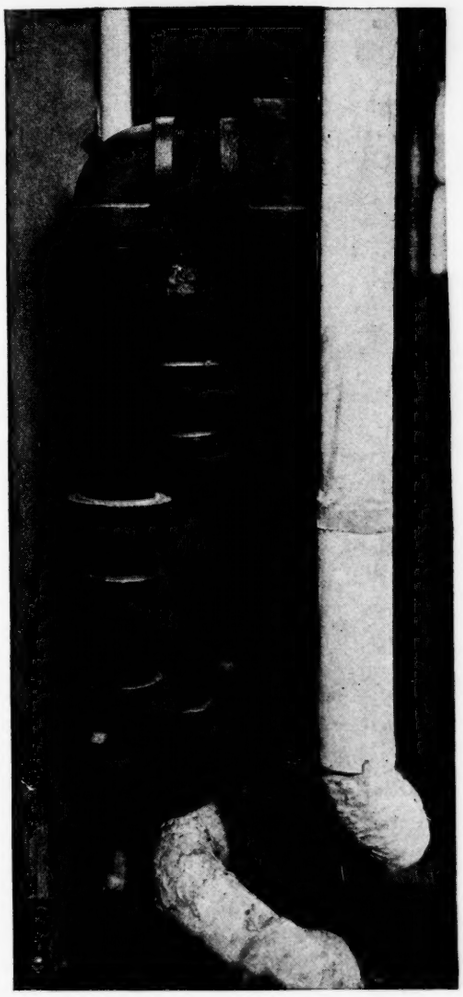
BUCKINGHAM BUILDING
Chicago

Why OWNERS, ARCHITECT and PLUMBING CONTRACTOR of this modern building chose

ARCO METAL

CAST IRON PIPE

VERTICALLY CAST
SEAMLESS



Arco Metal Pipe is carried in stock and distributed by jobbers of plumbing, heating and mill supplies.

REGULARLY FURNISHED IN 12 FT. LENGTHS

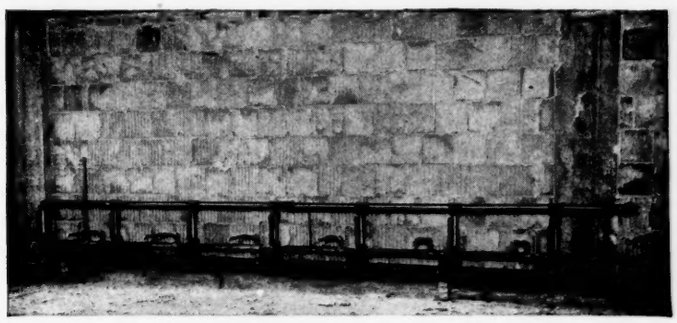
ARCO METAL PIPE IS EASY TO INSTALL. "We experienced no difficulty in handling this installation due to breakage, and the job tested perfectly tight" to use the words of the contractor, M. J. Corboy.

This is made possible by the method of manufacture and the fine grade of cast iron used in producing Arco Metal Pipe.

ARCO METAL PIPE INSURES PERMANENCE. The owners of the Buckingham Building realize the cost and inconvenience of replacing pipe. To guarantee against this they chose Arco Metal Cast Iron Pipe for all soil, waste, vent and down spout lines.

In order to cut and thread cast iron pipe it must be perfectly round, uniform in wall thickness and true in outside diameter the full length of the pipe. The cast iron must be readily machinable and strong enough to stand the usual handling.

Arco Metal Pipe fills all of these requirements. It is cast vertically in dry sand molds which gives a perfectly round seamless tube. The iron is alloyed with nickel and chromium which makes it stronger and even more corrosion-resisting than ordinary cast iron and is easily cut and threaded with standard, hand or power tools.

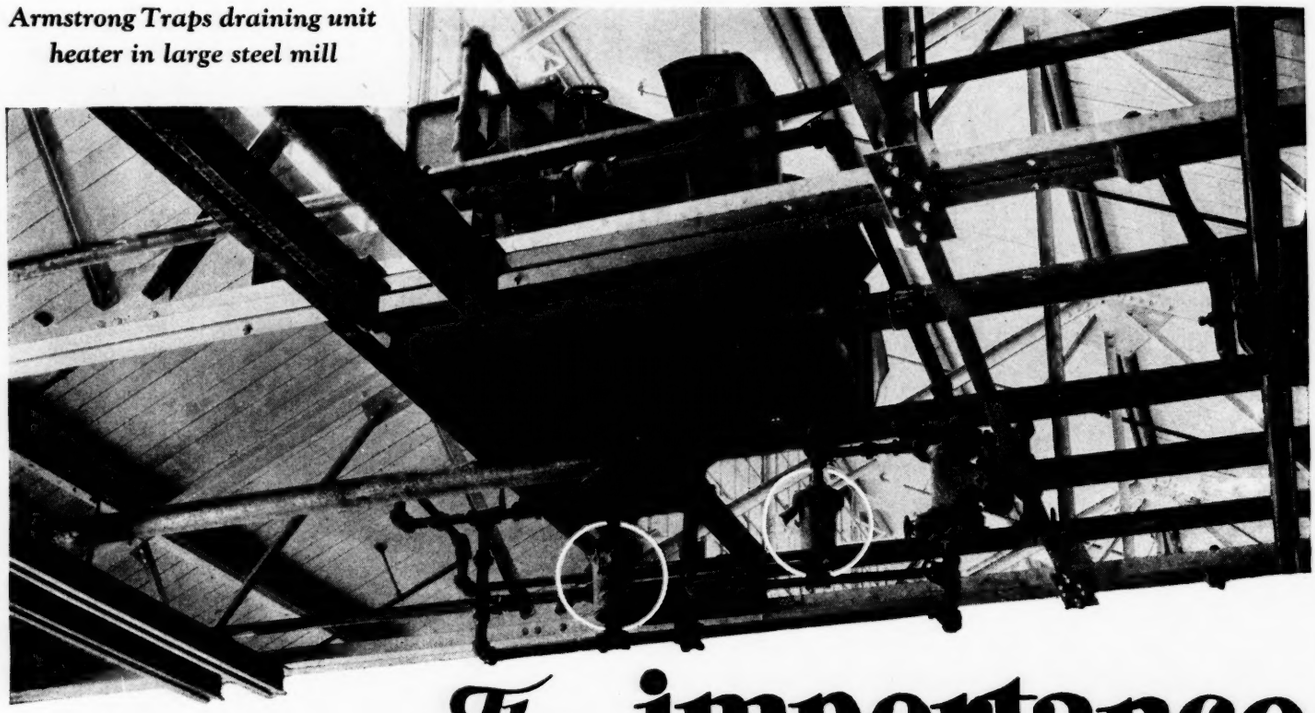


·ARCO·ARCO AMERICAN RADIATOR COMPANY ·ARCO·

ARCO METAL PIPE DIVISION

40 West 40th Street, New York
816 So. Michigan Avenue, Chicago
1344 Broadway, Detroit
8th and Broadway, Cincinnati
1294 East 55th Street, Cleveland
4201 Duncan Avenue, St. Louis

Armstrong Traps draining unit heater in large steel mill



The importance *of the* right trap *on* unit heaters

THE owner of a unit heater that is not equipped with the right trap gets just as unsatisfactory performance from it as he does from an automobile engine fitted with a badly adjusted carburetor.

Many heating engineers are therefore specifying Armstrong inverted bucket steam traps for unit heater installations. These traps keep the heater up to full efficiency at all times because of these Armstrong features:

—*large capacity.* In pounds of water discharged per hour (the only scientific way to measure steam trap capacity) Armstrongs have greater capacity than most traps of much larger size.

—*small size.* This is especially important with unit heaters suspended in mid-air. Armstrongs can be supported by connecting pipes.

—*no airbinding;* no clogging from scum or sediment (Armstrongs are self-scrubbing); no steam leakage (they are always water-sealed); no wire-drawing (chrome steel valves).

All these features make the Armstrong Trap practically foolproof. They operate years without attention. Repair expense is negligible. We will gladly send data on heating systems and catalogs at your request.

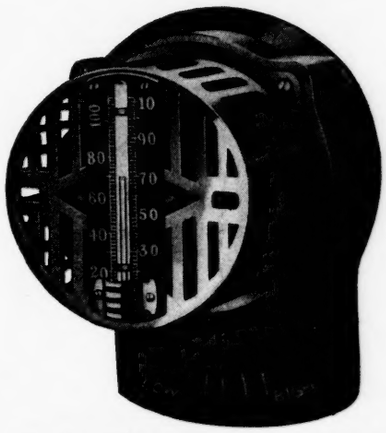
ARMSTRONG · INVERTED BUCKET · STEAM TRAP · TRADE MARK

ARMSTRONG MACHINE WORKS
THREE RIVERS, MICHIGAN
District Representatives in 42 Cities

H & V 6 Gray

TIME-O-STAT'S CON-TAC-TOR MERCURY SWITCHES *assure Dependable Temperature Control . . .*

This Con-Tac-Tor Mercury Switch is an exclusive Time-O-Stat product. There is always a clean, positive switching action—free from the arcing, pitting, burning, and corroding to which open-contact switches are subject. Its use gives *longer life* to Time-O-Stat Controls.



The No. 135 Thermostat—an ideal room temperature control with a Con-Tac-Tor Mercury Switch. There are thousands of these dependable instruments in use in American homes today.

THE *Switch* is the heart of all electrically-operated automatic controls... Time-O-Stat controls have Con-Tac-Tor *Mercury Switches*—the most durable and dependable switches known! Their high capacities and simple, sturdy, *compact* construction assure reliable temperature control. Where Mercury Switches are used there are no open contacts to burn or wear out, to corrode or catch dirt,—no elaborate mechanisms demanding frequent adjustment.

The No. 135 Thermostat — at the left — is a sensitive, reliable, *permanent* room temperature control operated by a Con-Tac-Tor Mercury Switch. It maintains room temperature within a variation of 2° F.

Send the coupon for detailed information on Time-O-Stat automatic controls—with Con-Tac-Tor *Mercury* Switches.

TIME-O-STAT CONTROLS COMPANY

ELKHART, INDIANA

Branch Offices and Exclusive Distributors in All Principal Cities of the United States.

Canadian Distributors: **Toronto and Montreal.**

Export Department: **New York.**

Manufacturers of AUTOMATIC CONTROLS *for Oil Burners — Gas Burners — Coal Burners — Electric Refrigerators — Furnace Fans — Mechanical Stokers — Industrial Ovens — Ice Machines — Unit Heaters . . . . . also of Sign Flashers — Mercury Switches — Electric Heaters — Corrugated Metal Bellows.*

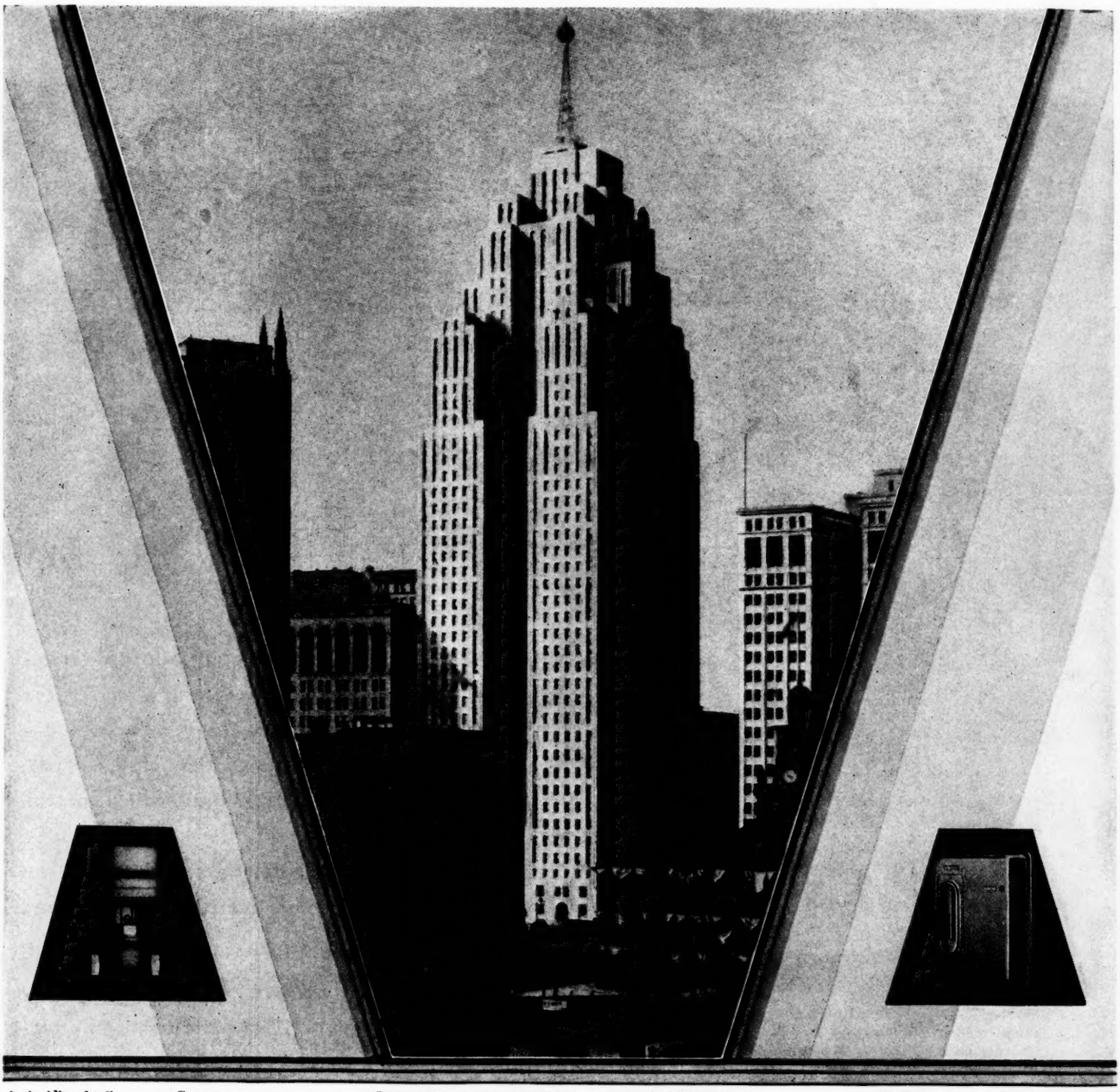
TIME-O-STAT CONTROLS COMPANY Dept. 3
Elkhart, Indiana

Without obligation on my part, send me full information on Time-O-Stat automatic controls — with Mercury Switches.

Name.....

Address.....

Company.....



A. A. Albrecht Co. . *Contractor*

Greater Penobscot Building . . . Detroit, Michigan
Smith, Hinchman & Grylls . . . . . *Architects*

H. Kelly Co. . . *Heating Contractor*

GREATER Penobscot Building, 561½ feet high, 47 floors, is completely equipped with Johnson Heat & Humidity Control. On the second to the fifth floors, inclusive, (occupied by the Guardian-Detroit Bank and the Guardian Trust Company), Johnson regulation is on the direct radiation and the air conditioning. The sixth to the forty-seventh floors, inclusive, (devoted to miscellaneous offices) have Remote Control on the riser valves, divided into thirty-six zones—so that steam may be supplied to or shut off from any zone desired. This is an example of the various applications of Johnson Heat & Humidity Control, and another impressive reference endorsing Johnson leadership.

JOHNSON SERVICE CO. . . . . MILWAUKEE, WIS.
ESTABLISHED 1885
Branches In All Principal Cities
Interesting Johnson Catalog Sent On Request

JOHNSON HEAT & HUMIDITY CONTROL

Standardize on

WALWORTH
VALVES
FITTINGS
AND TOOLS

for

PLUMBING AND HEATING

STANDARDIZE ON WALWORTH
the complete QUALITY line

• The leading Walworth distributors carry a full supply of all Walworth products that you may need. • Their service enables you to order from a complete line of high quality valves, fittings and tools that have been tested and proved for dependability in thousands of other plumbing installations. •

• For low or high pressures, for routine or severe service, the Walworth line will live up to your most exacting demands for safety and economy of operation. •

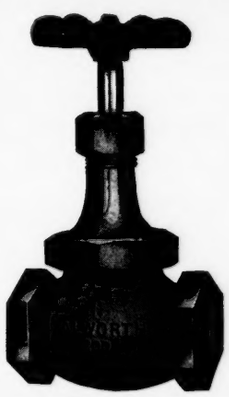


FIG. 207B GLOBE VALVE

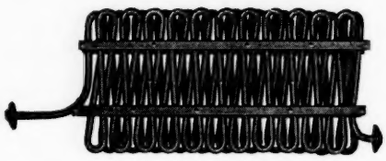
FIG. 207C ANGLE VALVE

• FIG. 207B • FOR 200 LBS. W. S. P. • One of the outstanding quality products in the Walworth line is this heavy bodied valve of tough bronze. . . the Walworth 200 lb. Valve, with a seat and disc of SIGMALLOY 222 (a nickel alloy which is especially effective against corrosion and any kind of hard, smashing service.) •

WALWORTH

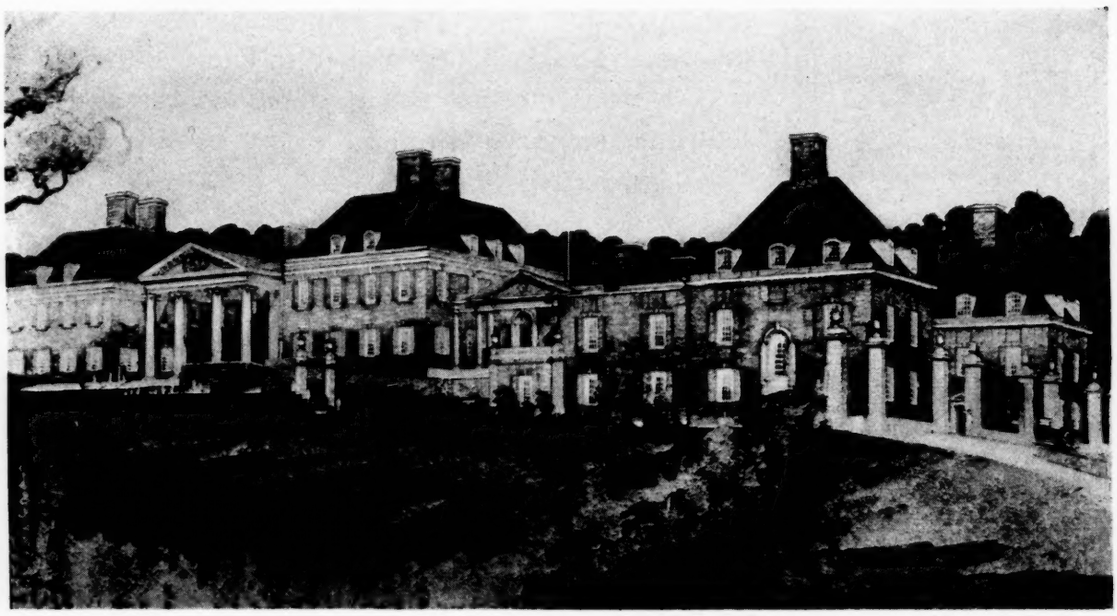
Walworth Company, General Sales Offices: 60 East 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa.; and Attalla, Ala.
Walworth Company Limited, 660 St. Catherine Street West, Montreal, P. Q.
Walworth International Co., 11 Broadway, New York, Foreign Representative
. . . Distributors in Principal Cities of the World . . .

WHITLOCK COILS



for Special Jobs

In the new British Embassy Building in Washington



Wolff & Munier, *Heating Contractors.* Jaros & Baum, *Consulting Engineers.*
Richard Crittall & Co., Ltd., *Designers of Panel System.*

The Panel Heating System is equipped with Whitlock Coils throughout. Whitlock Coils, like Whitlock Heaters, are built to exacting standards, and represent the latest developments in both design and construction.

For information or engineering service on Whitlock Products consult the nearest Whitlock District Office or representative in New York, Boston, Philadelphia, Chicago, Detroit, Baltimore, Charlotte, Los Angeles, San Francisco and other principal cities.

Look under our name in your local telephone directory or drop a line to us at:

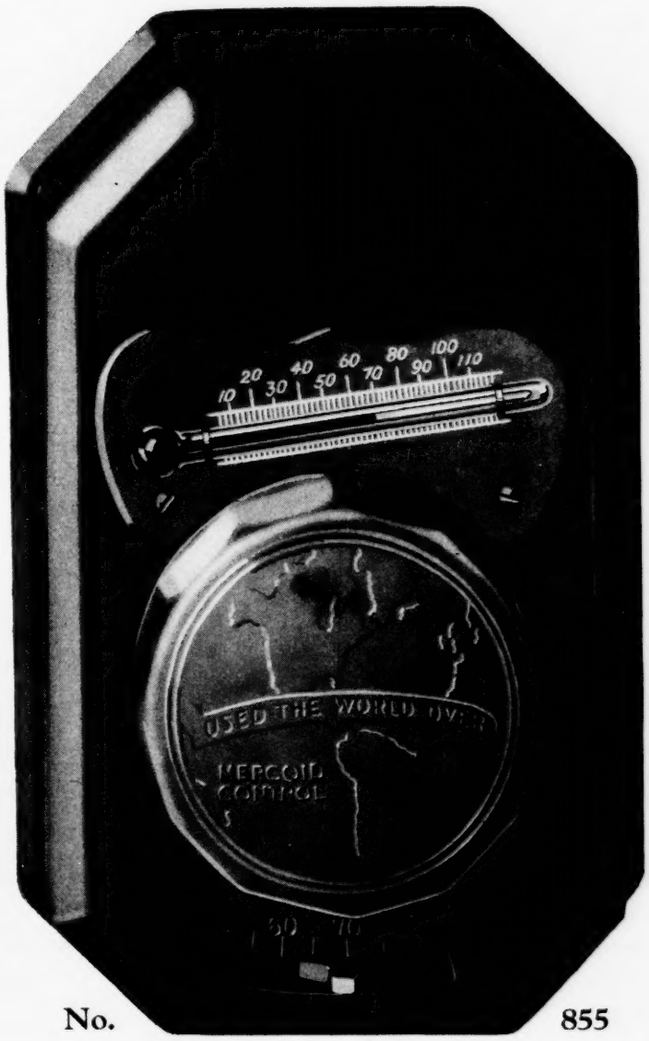
THE WHITLOCK COIL PIPE CO , 40 South St., Hartford, Conn.

WHITLOCK SERVICE WATER HEATERS

WHITLOCK COILS and FLANGES

WHITLOCK HEAT TRANSFER EQUIPMENT

New Mercoid Thermostat for Unit Heaters



No. 855

This instrument is unique in design. The thermal element is exposed directly to the room temperature, thereby insuring the utmost sensitivity to temperature changes.

Neat in appearance and positive in operation.

The No. 855 Thermostat will control motors directly across the line where the normal working loads do not exceed 10 amperes at 110 volts or 5 amperes at 220 volts A.C. or D.C.

The Standard range of this instrument is from 56 to 80° F. or 38°—60° F. It has an operating differential of 1½ degrees.

Write for further information regarding this new development.

MERCOID CONTROLS

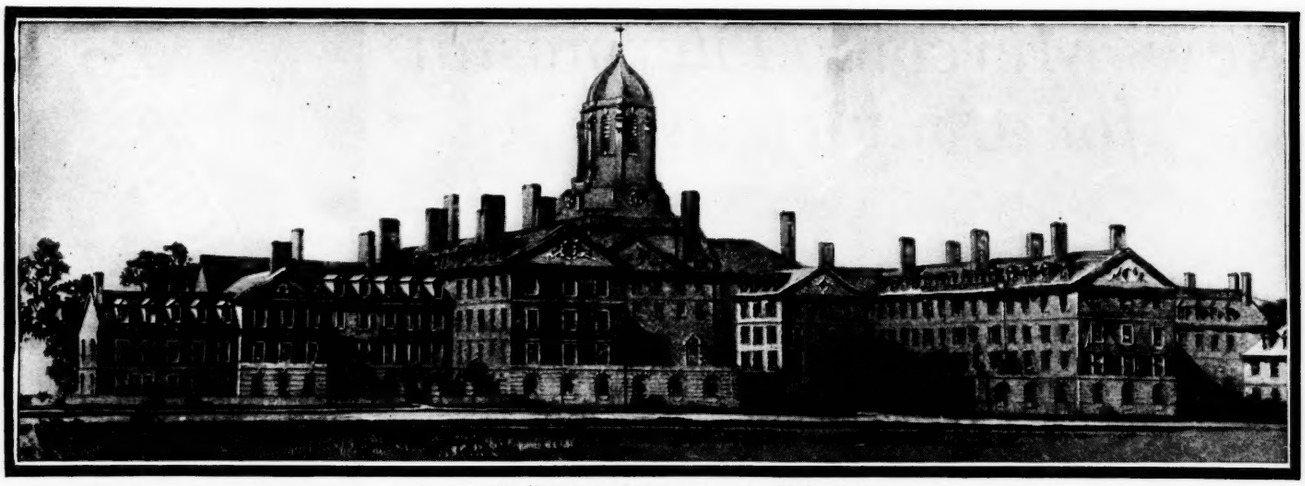
THE MERCOID CORPORATION

4201 BELMONT AVE. Chicago, Illinois, U. S. A.

25 CHURCH STREET
New York, N. Y.

1129 FOLSOM STREET
San Francisco, Calif.

Cable Address "Mercoid" Chicago

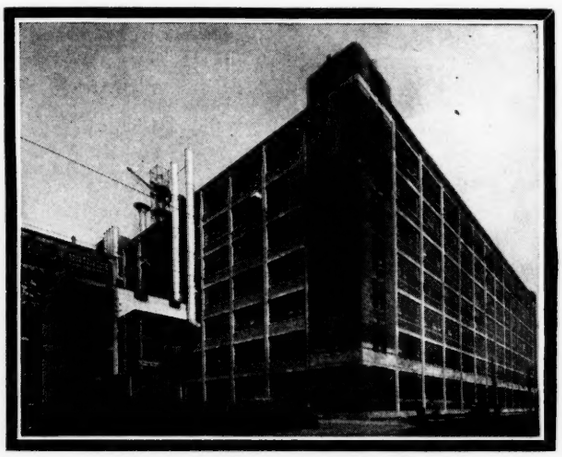


Dunster Hall, Harvard University, Cambridge, Mass.

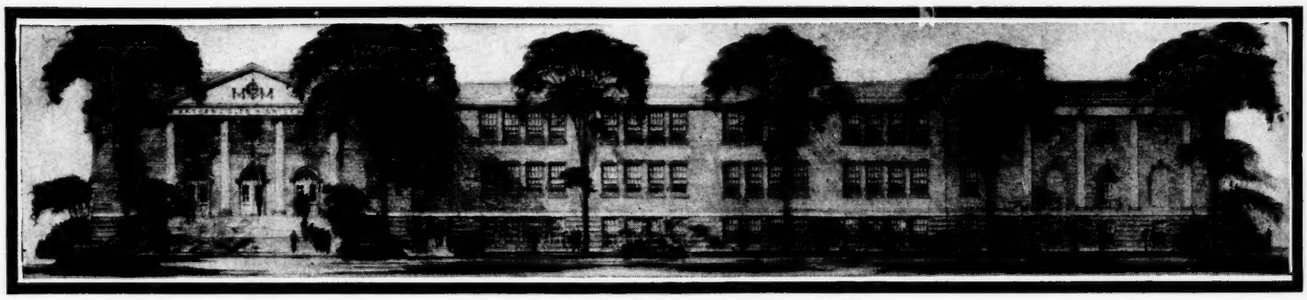
In these new buildings . . .

ARCOBLAST
ENCASED HEATERS

S. S. Kresge Co., Detroit



Murray Corporation of America, Detroit



Watkins Glen High School, Watkins Glen, N. Y.

IN the modern buildings shown here Encased Arcoblast was installed for indirect heating. Its light weight makes it possible to install in almost any kind of building, and its design—3/4 inch copper tubes with spirally wound fins secured in special shaped cast iron headers gives good thermostatic control.

• Arcoblast is built for steam pressure from 5 to 200 pounds with no soldered steam-backed joints. The encasement of black sheet metal is galvanized and ready for pipe connections.

• We will be glad to send you complete information on engineering data.

AMERICAN RADIATOR COMPANY

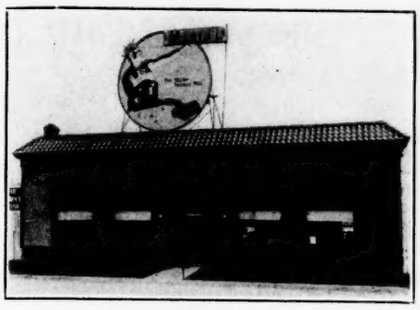
816 So. Michigan Ave. Chicago, Ill.

40 West 40th Street New York, N. Y.

PLAIN TALKS ON OIL BURNER PROFITS

No. 2—"What Will It Cost to Run?" How Dealers Cash in on ELECTROL ECONOMY

You can't get away from the question "What Will it Cost to Run?". The phrase "It isn't the **first cost** but the **upkeep**" has now become a household expression which no dealer can evade. Electrol dealers know the answer to this question and meet it squarely—and successfully.



SWIFT LUMBER & FUEL CO., Lincoln, Neb. In the sale of Electrol Oil Burners the Swift Lumber & Fuel Company have been conspicuously successful. Their growth is particularly noteworthy because in their territory the cost of fuels which compete with oil are less than the national average.

TAKE MR. SWIFT'S WORD FOR IT.

"The prospect naturally wants facts on operating costs. This is often a stickler because it involves a few variables. The danger lies in dwelling too much on the variables and not enough on factors which are known. The whole question is one of comparisons. First, with other fuels; second, with other oil burners. We've taken the trouble to get actual working figures which we find appeals to the common sense of our prospects. As a result, operating costs do not seriously hinder us in making sales."

COMMON SENSE COMPARISONS

Mr. Swift certainly hits the nail on the head. Why become involved in the variables of operating costs when constructive facts are available? Everybody knows that the best oil burner won't make a coal-hog furnace efficient. Everybody knows people use more heat when they own an oil burner. But in spite of this the majority of Electrol owners report a saving over other fuels. The most effective answer is to submit some actual examples of Electrol operating costs—then check off point by point the reasons for Electrol economy. Here are some of them:

NO GAS TO PAY FOR. Electrol is all-electric, eliminating the needless expense of gas ignition.

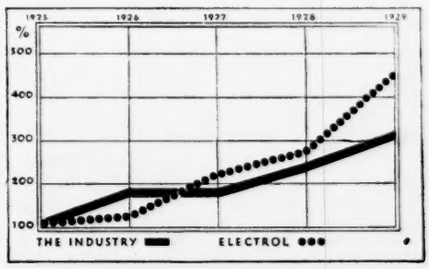
BURNS CHEAPER OIL. Electrol is listed by the Underwriters' Laboratories to burn the heavier, cheaper grades of oil. This rolls up a snug saving during the heating season.

THRIFTY IN OPERATION. The Electrol curved air chamber whirls air and oil together in a way which insures economical combustion. It produces a turbulent ball-shaped flame which burns s-l-o-w-l-y in the fire-box not up the flue. This means more heat to the gallon.

ONLY ONE MOTIVE PART. The fan and oil pump are directly coupled to the motor shaft which is the only motive part. This cuts down service requirements and replacements.

CORRECT IN DESIGN. Simplicity is the key-note of Electrol design. Simplicity of installation — simplicity of adjustment—simplicity of servicing.

FLEXIBILITY. Quickly and easily adaptable to any type of heating plant, Electrol meets the exact needs of each particular job.



GROWING FASTER THAN A FAST-GROWING INDUSTRY. Since 1925 the Oil Burner industry tripled its growth —in the same period Electrol's growth has been 4½ times. From 6th place to 3rd in the last three years.

BACK OF ELECTROL'S LEADERSHIP. For 12 years Electrol's growth has been sure and steady. Its product was right from the start and kept right. Its policies have been conservative and constructive rather than spectacular. Its management has the quaint idea that it can succeed only to the extent that its dealers succeed.

Member of the Oil Heating Institute.

FOR THE HEATING CONTRACTOR— A PROFIT EITHER WAY

1. **THE ELECTROL FRANCHISE.** There's a nice profit in the Electrol Franchise for the Heating Contractor. This is abundantly proved by the success achieved by many leaders in the business.
2. **THE ELECTROL COOPERATIVE PLAN.** You will find the Electrol dealer in your territory prepared to make an attractive cooperative arrangement. One that adds to your income; safeguards your professional reputation and requires no extra investment. Let us give you details.

ELECTROL

The OIL BURNER *with the Master Control*

ELECTROL, INC., H
227 East 45th Street, New York
I would like to know more about—
The Electrol Franchise_____
The Electrol Cooperative Plan_____
Name_____
Address_____
City_____State_____

Enclosures
by
SLYKER
with Robras Radiators
in this modern New York
Apartment Building

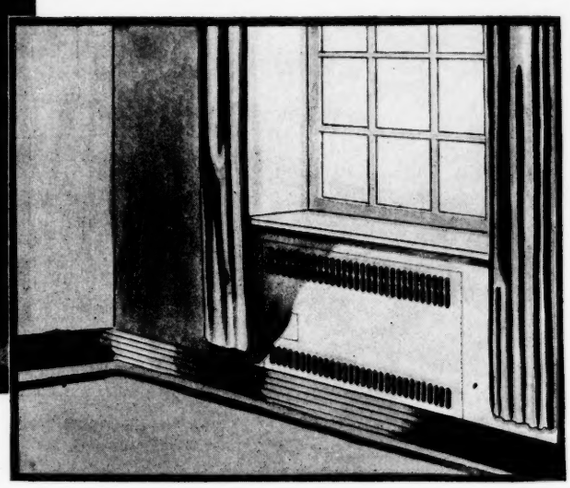
Building: Eleven-Twenty Park Avenue
Architect: Geo. Fred. Pelham
Heating Contractor: W. G. Cornell Company
Owner and Builder: Marcus Brown Construction Co., Inc.

Slyker Enclosures have again been chosen for another of New York's fine new apartment hotels—the ELEVEN-TWENTY PARK AVENUE BUILDING, at 90th Street and Park Avenue.

This selection of Slyker Enclosures is in conjunction with Robras Concealed Radiators, both of which have been installed throughout this modern new apartment building.

We invite the inquiries of Builders, Architects and Heating Contractors, to whom we offer full cooperation in ***simplifying*** heating problems, regardless of the radiator selected.

Illustrated below is the installation furnished by SLYKER—recessed lining and removable grille front—convenient access to radiators when desired.



"SAVE WITH STEEL"

SCHLEICHER, *Inc.*

Manufacturers of SLYKER Steel Radiator Enclosures

GARY, INDIANA

SLYKER Showrooms in All Principal Cities of U.S.A.

OUR CONTRIBUTION TO THE ART OF HEATING AND VENTILATION

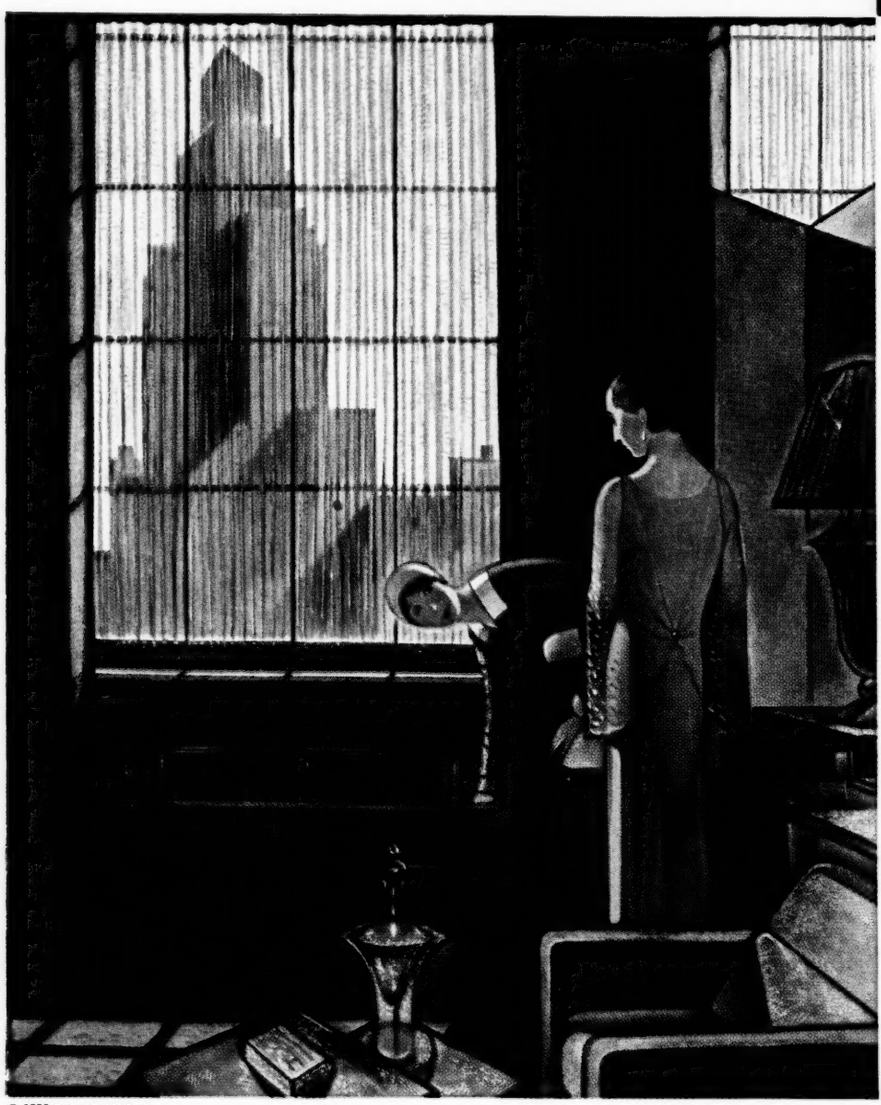
The Herman Nelson Wedge Core Radiator is an exclusive feature of all Herman Nelson Heating and Ventilating Products and accounts for their satisfactory performance. ✣ ✣ ✣ ✣

THE HERMAN NELSON CORPORATION MOLINE ILLINOIS

BEHIND THAT GRILLE IN THE WALL

there's a radiator that says..."This building is modern"

Herman Nelson Invisible Radiator being installed in thousands of new office and apartment buildings, hotels, hospitals, residences and similar structures . . . closes high grade contracts and eliminates trouble jobs for heating contractors.



© 1930 T. H. N. CORP. E

Heating contractors who would lift themselves out of the competition of price, are discovering a wealth of opportunities in the Herman Nelson Invisible Radiator. For here is a radiator, not merely designed for installation within the wall, but built to give the high type of heating service fine buildings require.

It has no joints of any kind to fail and leak —no parts that can rust or get out of order. Once you install it, you can count your profit *as profit.*

The radiator, which comes enclosed in a scientifically designed steel case, is easy to install in any standard wall or partition. For larger and taller buildings a removable panel is provided, permitting instant access to controlling valves, traps and all connections.

Why not have full information about this radiator that has been so enthusiastically received by both the heating and building professions? Write for our engineering data book and other interesting facts.

THE HERMAN NELSON CORPORATION,* Moline, Ill.

HERMAN NELSON *Invisible* RADIATOR

BELFAST, ME.
BOSTON
SPRINGFIELD, MASS.
PROVIDENCE, R. I.
NEW YORK CITY
SYRACUSE
ALBANY
BUFFALO
PHILADELPHIA
SCRANTON

HARRISBURG
PITTSBURGH
JOHNSTOWN, PA.
WASHINGTON, D. C.
CHARLOTTE, N. C.
GRAND RAPIDS
SAGINAW, MICH.
FLINT, MICH.
DETROIT

CLEVELAND
CINCINNATI
TOLEDO
LOUISVILLE
INDIANAPOLIS
CHICAGO
PEORIA, ILL.
DES MOINES
MILWAUKEE

GREEN BAY
MINNEAPOLIS
DULUTH
ST. LOUIS
BIRMINGHAM
ATLANTA
NEW ORLEANS
MEMPHIS
DALLAS

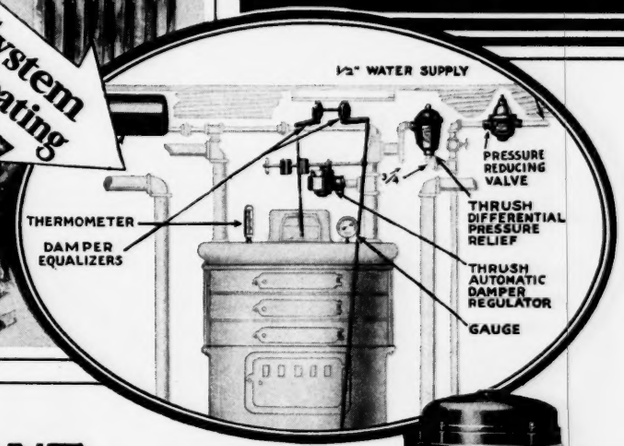
OMAHA
EMPORIA, KAN.
KANSAS CITY
TULSA, OKLA.
DENVER
SALT LAKE CITY
BUTTE, MONT.
SPOKANE
PORTLAND, ORE.

SEATTLE
SAN FRANCISCO
VANCOUVER
TORONTO
WINNIPEG, MAN.
CALGARY
LONDON
OSLO
MELBOURNE
TOKIO, OSAKA

*Makers of the *Herman Nelson Invisible Radiator,* for residences, apartments, hotels, offices and monumental structures — the *Univent,* for the ventilation of schools, offices, churches and all buildings having an acute ventilating problem — the *Herman Nelson hiJet Heater,* for economical distribution of heat in factories, mills, garages, warehouses, and smaller buildings.

EFFICIENT HOME HEATING

Thrush Class "A-A" System of Hot Water Heating



COMFORT WITHOUT CEASELESS SHOVELING

SELL your customers *comfort and health*—the two fundamental requirements for a happy existence. Certainly an efficient heating plant is absolutely necessary for the enjoyment of those two things, as home owners will agree . . . *and your Sales are easier.*

The *mild, even heat* produced by a Hot Water System is healthful and when that Hot Water Heating Plant is *Thrush equipped*, it becomes the most *efficient, convenient* and *economical* heating method for residence use.

Thrush System *accelerates circulation, provides automatic* relief of excessive pressures, *automatically maintains* the water level in the system *and automatically controls* the drafts, giving heating comfort without ceaseless effort. It is also ideal equipment for oil and gas burning jobs.

H. A. THRUSH & CO.

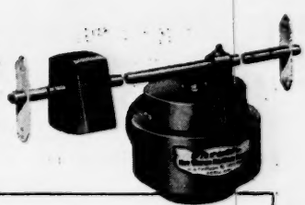
PERU, INDIANA

Accelerated Circulation

Add the Thrush Electric Circulator, shown at the right, to the Thrush Class "AA" System, shown above, to provide Forced Circulation which is positive under almost any conditions regardless of the location of the boiler.

The Thrush Differential Relief Valve at the left provides absolute safety from excessive pressures in the boiler. It is fully guaranteed and tested by many years of satisfactory operation.

At the right is the Thrush Automatic Damper Regulator which controls temperatures, keeping the heat mild, healthful and lowering fuel consumption.



THE NEW THRUSH SYSTEM OF ACCELERATED HOT WATER HEATING

H. A. Thrush & Co.
Dept. A. Peru, Ind.

Please send me the new Thrush catalog and detailed information about Thrush Class "AA" System of Accelerated Circulation.

Name.....

Address.....

90% of Baldor Users Repeat!

IT is highly significant that of the many firms which have ever bought Baldor Ball Bearing Motors, 90% are still active customers.

Only one thing could bind such a high percentage of users in so many different fields so continously to a product. That thing is Baldor performance . . . one important feature of which is the ability of Baldor ball bearing motors to completely eliminate the thrust and lubrication problems of the sleeve bearing type motors.

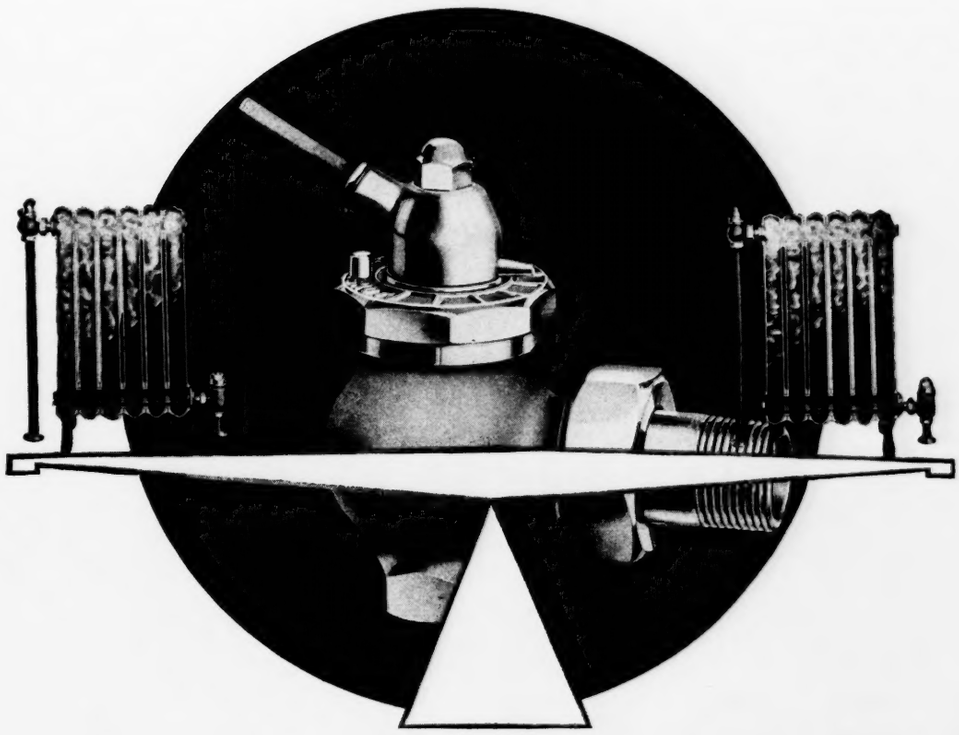
Naturally, firms which recognize the practically trouble-proof quality of ball bearing motors look to Baldor—who has always specialized in ball bearing designed motors and who has had 10 years time in which to perfect the Baldor Ball Bearing motor line.

Windings for all current characteristics. Ask for folder. Baldor Electric Co., 4356 E. Duncan Av., St. Louis, Mo. U.S.A.

BALDOR

A BETTER BALL BEARING MOTOR

Eliminates Thrust and Lubrication Problems



BALANCED

from the word go!

In the new IMPROVED Webster Type "R" Systems the supply of steam to each radiator is so equalized and balanced that all radiators get steam at the same time and in substantially the same proportion, regardless of distance from the boiler.

Fool-Proof

The balancing is done right from the plans by a Webster Steam Heating Specialist. Contractors are provided with a definite schedule to insure correct installation. Tedious guesswork efforts at balancing after installation are eliminated. And once balanced, *it cannot be unbalanced by the room occupant.*

Modern as Tomorrow

The new IMPROVED Type "R" System meets fully the operating requirements of the newer fuels such as oil and gas, the newer types of light-weight radiation, the new thermostatic controls, and at the same time provides the last word in heating efficiency for systems using older fuels, older radiation and older controls.

A New Modernization Opportunity

Like all advances in Webster Systems these improvements may be incorporated into existing Webster installations. All necessary information is available now at the nearest Webster Branch office. Call on them for complete cooperation or use the coupon below for a bulletin covering this newest Webster development.

-since 1888

Webster

Systems of Steam Heating

Warren Webster & Company, Camden, N. J.
Pioneers of the Vacuum System of Steam Heating
Branches in 52 principal U. S. Cities—Darling Bros., Ltd., Montreal, Canada

aR-23

WARREN WEBSTER & COMPANY, Camden, N. J.: I am preparing plans and specifications in which I would like to consider an IMPROVED Webster System. ☐ Have your representative get in touch with me. ☐ Send new bulletin.

NAME..... ADDRESS.....

H.V. 6-30

There... that's where to put the radiator!

Clinton, Mass., Savings Bank, Hutchins & French, Archts., J. E. Chatman, Engr., Lynch & Woodward, Heating Contrs.

There... in the walls, out of sight, out of the way!

Of course, it has to be a Robras 20-20 Radiator, because only Robras Radiators are *sure* to go into the "tight places." You'll find that these radiators go into all sorts of odd areas... in the wall studding... under stairs... in fact, in *any* space that is four or more inches deep.

You'll find, too, that Robras 20-20 Radiators are only 20 percent the weight and 20 percent the size of equivalent cast-iron radiation. Or, in other words, two men can install four or five times as many in a day.

There are other profitable features worth investigating. Price lists and data sheets are available. Interested? Let us have your name and address. ROBRAS 20-20

ROME BRASS RADIATOR CORPORATION, ONE EAST FORTY-SECOND STREET, NEW YORK, N.Y.

FILTERED AIR for CIVIC OPERA BUILDING

Seventeen Automatic Air Filters cleaning a total of over 300,000 C. F. M. protect the interior of this fine structure

Another outstanding building, thoroughly modern in every detail, ventilated with FILTERED AIR.

Graham, Anderson, Probst and White, Architects. ◇ John Griffiths and Son Company, General Contractor. ◇ Wolff Brothers, Ventilating Contractor.

AMERICAN AIR FILTER COMPANY, INC.

INCORPORATED

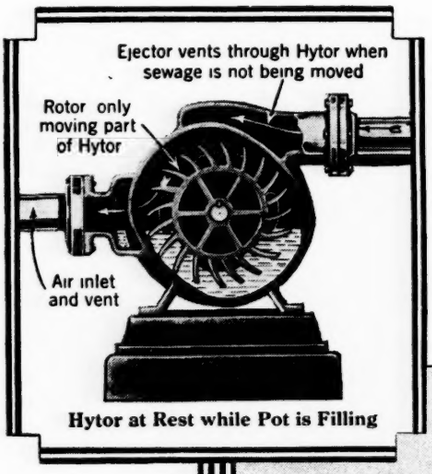
FIRST and CENTRAL AVENUE

AMERICAN

MIDWEST NATIONAL

Reed Air filters

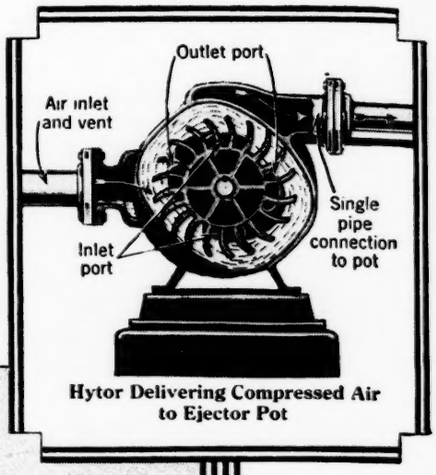
LOUISVILLE KENTUCKY



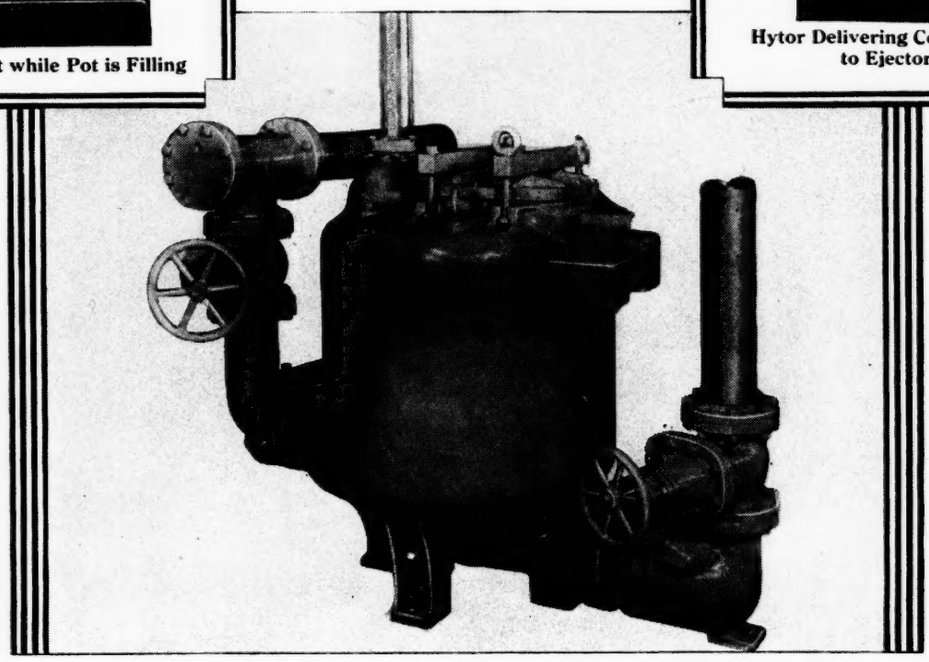
Hytor at Rest while Pot is Filling

How the Hytor works

The bladed rotor revolves freely in an elliptical casing filled with water. Turning with the rotor, the water is constrained to follow the casing by centrifugal force and alternately recedes from and is forced back into the rotor, twice in each revolution. As the water recedes from the rotor it draws in free air through the inlet ports. When the water is forced back into the rotor the air is compressed and discharged through the outlet ports to the receiving pot of the ejector.



Hytor Delivering Compressed Air to Ejector Pot



Jennings Pneumatic Sewage Ejectors are furnished in capacities ranging from 30 to 1500 g.p.m. Heads up to 50 ft Write for Bulletins 103 and 108.

Uses low-pressure air direct from compressor

no air valves—no storage tanks—no reducing valves

The Jennings Pneumatic Sewage Ejector is free from complicated, troublesome parts.

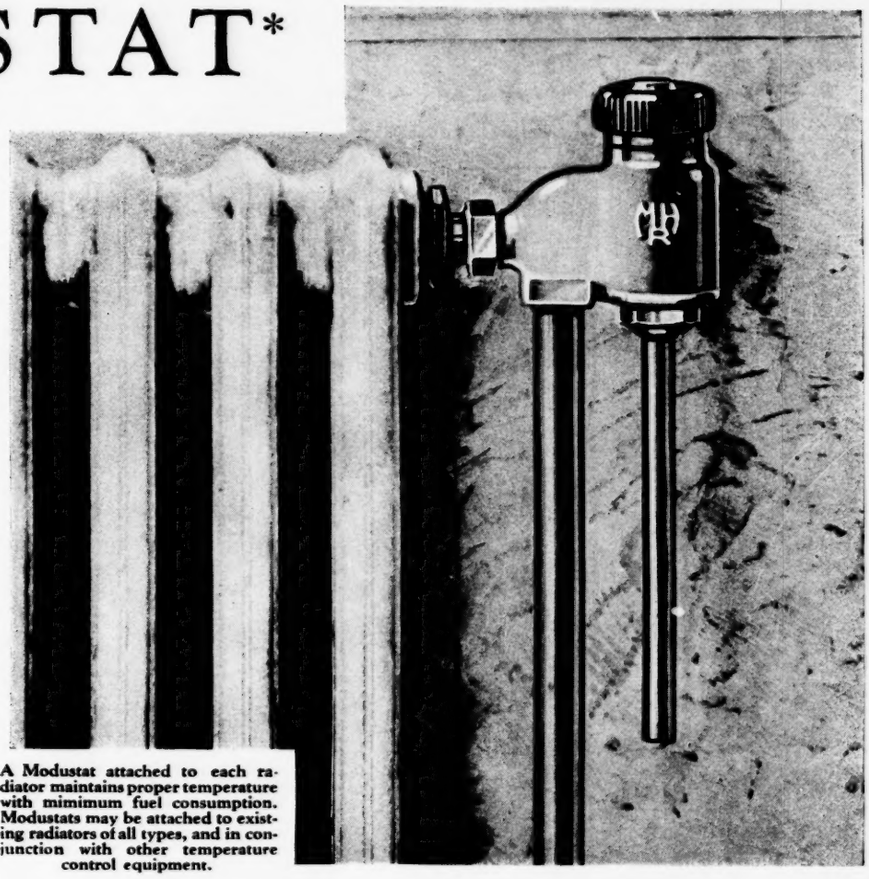
Operation is simple. As sewage accumulates in the receiving pot, it raises a float which when the pot is full, actuates a switch and starts the Nash Hytor Compressor. Air is then delivered by the compressor direct to the pot at the pressure required to force the sewage out. The reciprocating type of compressor, and the high pressure air storage tank required are avoided. Air valves and reducing valves, subject to leakage and a resulting waste of power, become unnecessary.

The Jennings ejector will give years of dependable service at low operating cost. It is trouble-free and requires little or no attention.

Jennings Pumps

THE NASH ENGINEERING CO 81 WILSON ROAD, SOUTH NORWALK CONN.

Every Radiator "Thinks" for Itself with the *new* MODUSTAT*



A Modustat attached to each radiator maintains proper temperature with mimimum fuel consumption. Modustats may be attached to existing radiators of all types, and in conjunction with other temperature control equipment.

Automatically maintains a temperature to suit the occupants of each individual room . . . . . .

Now the Modustat, a new type of self-contained *modulating* radiator valve, is available to bring new satisfaction to radiator heating systems. The Modustat lets each radiator act independently of all others—the valve automatically modulates so as to maintain any desired temperature.

Neat, simple, sturdy construction on a *new principle* insures accuracy and dependability. The Modustat is a worthy new member of the Minneapolis-Honeywell Regulator family, for 45 years in the forefront of heat control development.

In office buildings, hotels, hospitals, and the better class of homes and apartments, Modustats repay their cost in fuel saving. More comfortable and healthful conditions result from a smaller range of temperature variations. Minneapolis-Honeywell Regulator Company, 2715 Fourth Avenue South, Minneapolis, Minn.

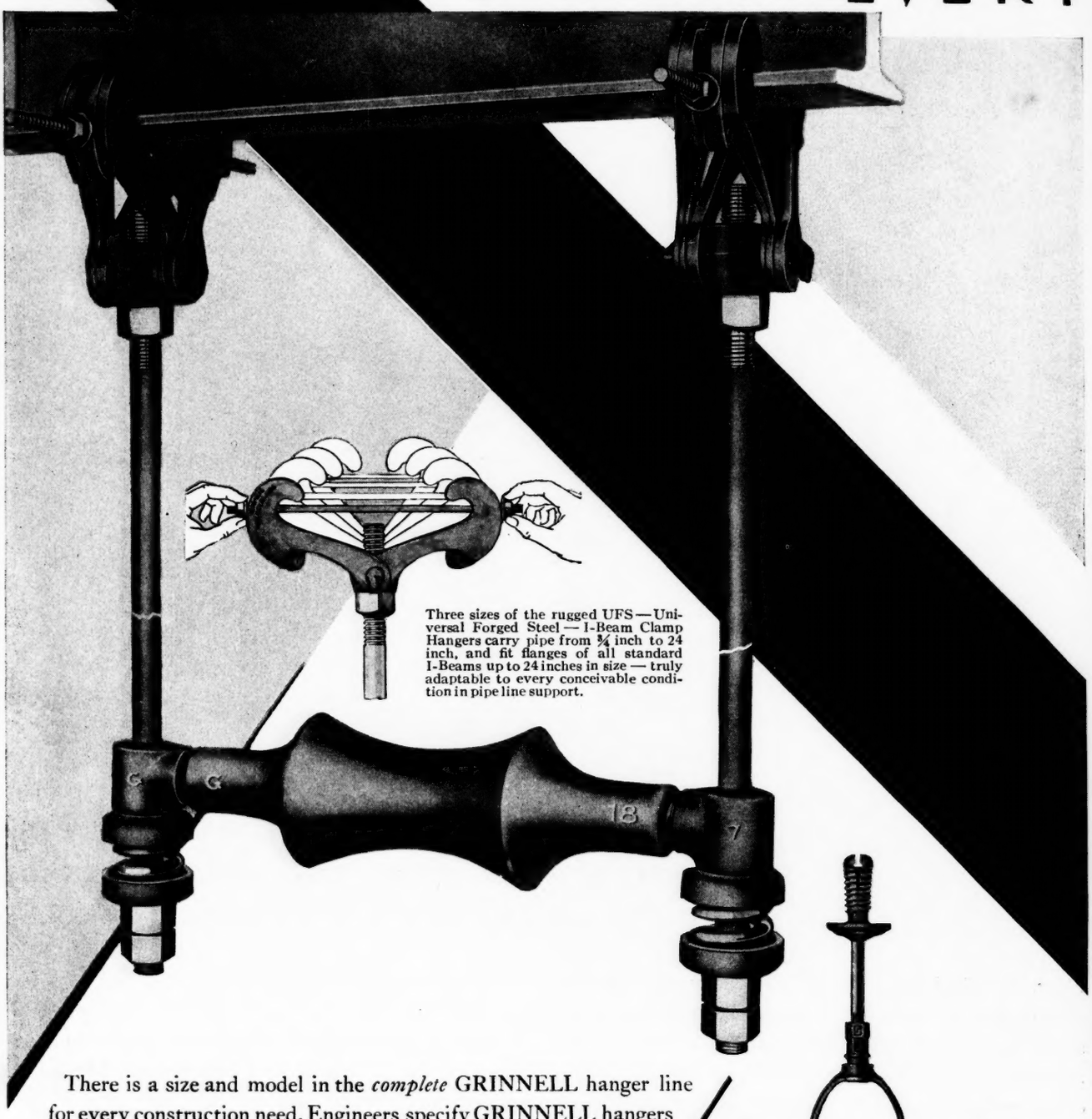
Automatic Temperature *and* Pressure Regulation

Minneapolis-Honeywell temperature and pressure controls and motor valves are available for every type of room or space heating installation. Send for our catalog.

MINNEAPOLIS HEAT REGULATOR HONEYWELL

RELIABLE *individual radiator control—an important new heating development.

THERE IS A GRINNELL HANGER FOR EVERY NEED



Three sizes of the rugged UFS — Universal Forged Steel — I-Beam Clamp Hangers carry pipe from ¾ inch to 24 inch, and fit flanges of all standard I-Beams up to 24 inches in size — truly adaptable to every conceivable condition in pipe line support.

There is a size and model in the *complete* GRINNELL hanger line for every construction need. Engineers specify GRINNELL hangers for many suspension jobs other than pipe lines: for suspended ceilings and floors, for temporary or permanent stagings; for conduits, etc.

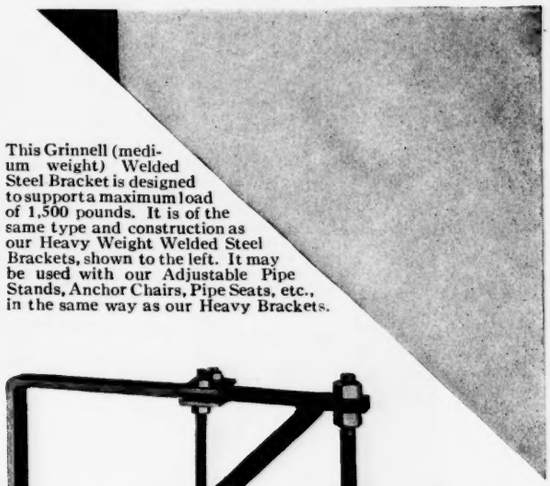
Contractors find GRINNELL hangers make for large savings over specials made on the job. And unlike the special job, their factor of safety is known. Compare this *assured* stress and strain factor with the unproved hand forged job.

Grinnell Adjustable Swivel Hangers lock themselves at the level where they are set. They are self-locking and they stay locked.

GRINNELL HANGER FOR CONSTRUCTION NEED

Grinnell (heavy weight) Welded Steel Brackets are designed to support a load of 3,000 pounds, yet are light in weight as compared with the usual cast iron bracket.

The Adjustable Pipe Stand shown with the Bracket is adjustable as to height by simply adjusting bolts on the roll stand. Lateral adjustment or movement is also possible with this Adjustable Pipe Stand by sliding the stand on the Welded Steel Bracket.



This Grinnell (medium weight) Welded Steel Bracket is designed to support a maximum load of 1,500 pounds. It is of the same type and construction as our Heavy Weight Welded Steel Brackets, shown to the left. It may be used with our Adjustable Pipe Stands, Anchor Chairs, Pipe Seats, etc., in the same way as our Heavy Brackets.

This Grinnell (light weight) Welded Steel Bracket is designed to support pipe lines up to and including 6-in. All sizes of this light bracket are designed for a maximum load of 750 pounds.

Bracket ends are drilled to take hanger rods up to and including ¾ in. in diameter.

Pipe 3½-in. and smaller may be hung from any other point on the horizontal member by using the Grinnell Steel Bracket Clip, shown at a midpoint on the horizontal number.

Grinnell Hangers Are Self-Locking

GRINNELL'S are the only swivel hangers that lock themselves at the level where they are set. They are self-locking and they stay locked.

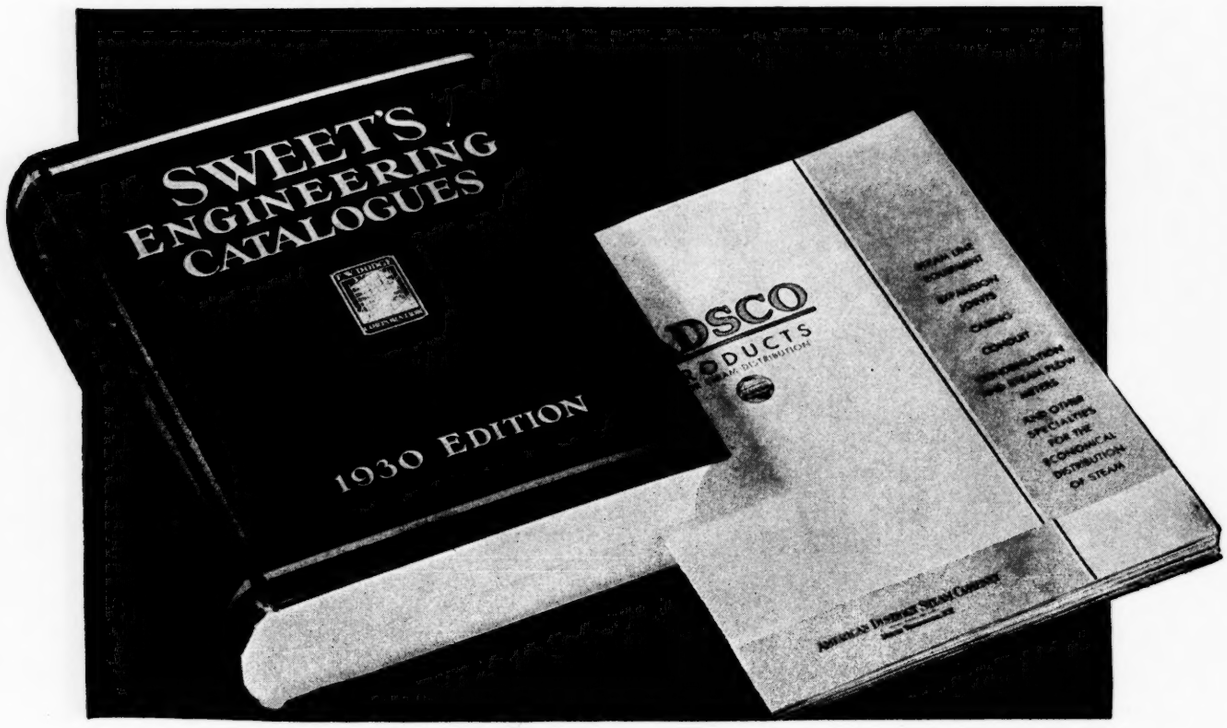
This self-locking feature is exclusive with GRINNELL *Adjustable* hangers. It permits straightening the line in a few seconds after any sagging due to foundations settling or unequal loading of floors. A few quick, easy turns of the self-locking swivel shank levels the pipeline up to T-square accuracy.

Write For The Data Book

You will find the GRINNELL Pipe Hanger Catalogue No. 5 *invaluable*. No other handbook gives these *detailed* diagrams and reference tables on pipe hangers and supports. Write for it today. Address Grinnell Co., Inc. 208 West Exchange St., Providence, R. I.

GRINNELL COMPANY

Executive Office Providence, R. I. ***Branches in all Principal Cities***



Turn to page 759 in SWEET'S

[40 pages of the steam distribution equipment used by 90% of the District Heating Utilities]

VALUABLE information on installing steam piping and the use of ADSCO Equipment is published this year as a 40 page section in Sweet's Engineering Catalogue. Whether you are laying out an underground steam line extending for thousands of feet, or merely a short interior line, you will find the information you need in the ADSCO section of Sweet's Engineering.

Many devices used in steam distribution, from expansion devices to steam flow meters, are illustrated and described. Tables are given for computing the amount of pipe expansion due to varying temperatures, as well as other data which is invaluable to any engineer who is called upon to specify steam line equipment.

ADSCO steam line specialties are used by over 90% of the large district heating utilities in America. Buried under city streets, their lines must "stay put" with little or no maintenance. Their profits depend on steam line efficiency. That is why they choose expansion joints and other equipment so carefully . . . and that is why they select ADSCO.

The efficiency of your steam lines can be assured with ADSCO Equipment. You can have the same degree of freedom from maintenance as the large district heating utilities. To familiarize yourself with the equipment used, see the ADSCO section in Sweet's 1930 Engineering Catalogue.

AMERICAN DISTRICT STEAM COMPANY

GENERAL OFFICES AND WORKS
NORTH TONAWANDA, N.Y.
FIFTY YEARS IN BUSINESS

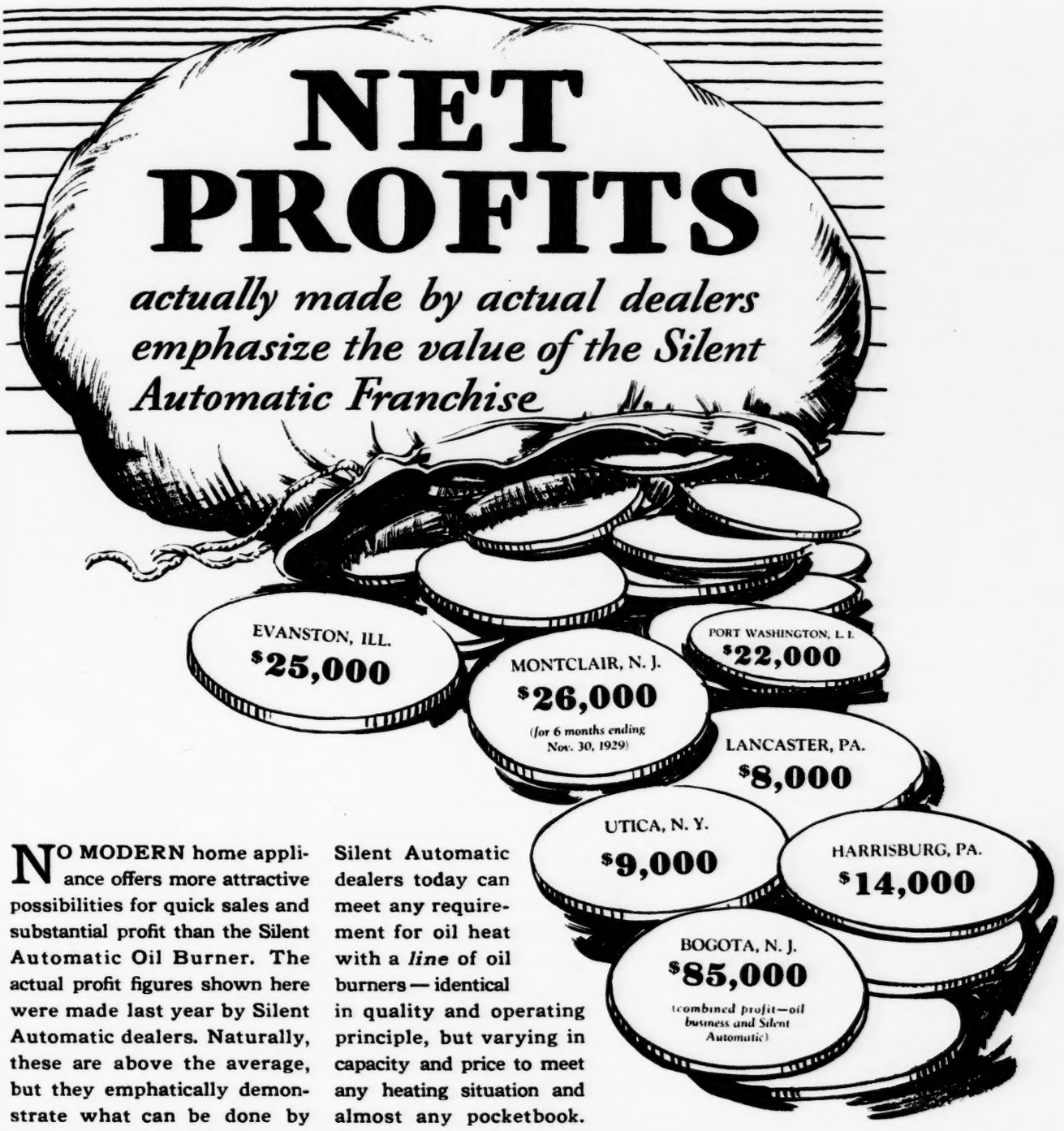
ADSCO

STEAMLINE EQUIPMENT

EXPANSION JOINTS, CASING, CONDUIT, CONDENSATION AND STEAMFLOW METERS AND OTHER SPECIALTIES FOR THE ECONOMICAL DISTRIBUTION OF STEAM

NET PROFITS

actually made by actual dealers emphasize the value of the Silent Automatic Franchise



NO MODERN home appliance offers more attractive possibilities for quick sales and substantial profit than the Silent Automatic Oil Burner. The actual profit figures shown here were made last year by Silent Automatic dealers. Naturally, these are above the average, but they emphatically demonstrate what can be done by good management and hard work—and there is nothing about these accomplishments which cannot be duplicated by any alert and progressive business man.

Silent Automatic dealers today can meet any requirement for oil heat with a *line* of oil burners—identical in quality and operating principle, but varying in capacity and price to meet any heating situation and almost any pocketbook. And the Silent Automatic franchise brings with it not only unusually complete merchandising cooperation, but real personal interest and factory assistance.

Write direct to the factory for information regarding the desirable territory still open.

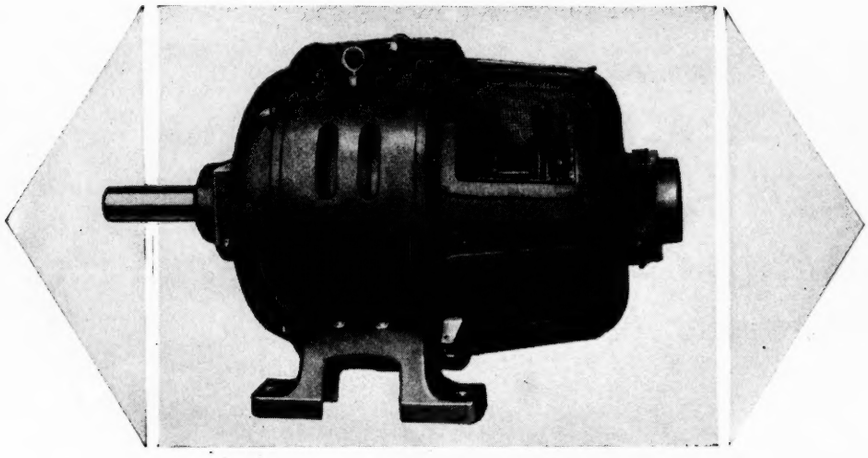
SILENT AUTOMATIC CORPORATION
12001 East Jefferson Avenue Detroit, Michigan

SILENT AUTOMATIC

THE NOISELESS OIL BURNER

(285)

THEY KEEP A-RUNNING



10 Horse Power Century Type SR Slip Ring Induction 3 and 2 Phase Motor

FOR STARTING EXCEPTIONALLY HEAVY LOADS

Wherever starting conditions are especially severe or where speed reduction is desirable, Century Type SR Slip Ring Induction 3 and 2 Phase Motors are particularly recommended...When equipped with speed control, their speed can be varied down to one-half of their normal or maximum ratings.

These motors are well balanced in design—no one characteristic is over developed at the expense of another ...The shafts are liberally proportioned...The bearings last—they are made of phosphor bronze, the best bearing material obtainable... Enclosing covers can be furnished in screen, grided, drip proof, fully enclosed or dust proof types.

Built in standard sizes from ¼ to 15 horse power.

CENTURY ELECTRIC COMPANY
1806 PINE ST. · · ST. LOUIS, MO.
40 U. S. and Canadian Stock Points and More Than 75 Outside Thereof

SINGLE PHASE, THREE PHASE, AND DIRECT CURRENT MOTORS

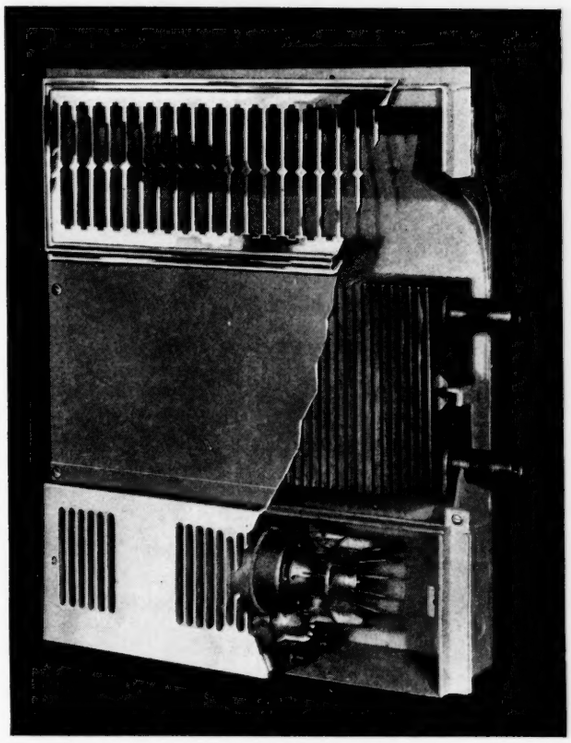
Century MOTORS

MOTOR GENERATOR SETS, ROTARY CONVERTORS, FANS AND VENTILATORS

614A

FOR MORE THAN 26 YEARS AT ST. LOUIS

Refreshing Coolness or Pervading Warmth



AERIET-EQUIPPED rooms are cooled in summer just as economically and effectively as they are warmed in winter. There is no blast as from the conventional fan, but the cooling, refreshing, vitalizing circulation of air that makes one room or many, healthful and comfortable whatever the temperature or the weather may be outside.

This is only one of many features of the Aeriet which make it the outstanding sensation in temperature engineering today. The Aeriet is concealed within walls or partitions—it frees architect and decorator from the interference of unsightly radiators. Aeriet makes the use of electricity as fuel, if desired, economically feasible and eliminates boilers and the paraphernalia of the conventional heating plant. Aeriet can be connected to hot water or steam lines and when so used, achieves an almost unbelievable fuel economy because it multiplies the heating efficiency of the B.T.U. And any installation of Aeriet provides *circulating* air in every part of the room, house or building.

You should know more about this marvelous new Air-Way Aeriet. We will gladly send you a book describing it in detail.

Air-Way
TRADE MARK
AERIET

Use This Coupon

Air-Way Electric Appliance Corporation
Toledo, Ohio
Please send me the Air-Way Aeriet book.

Name .....

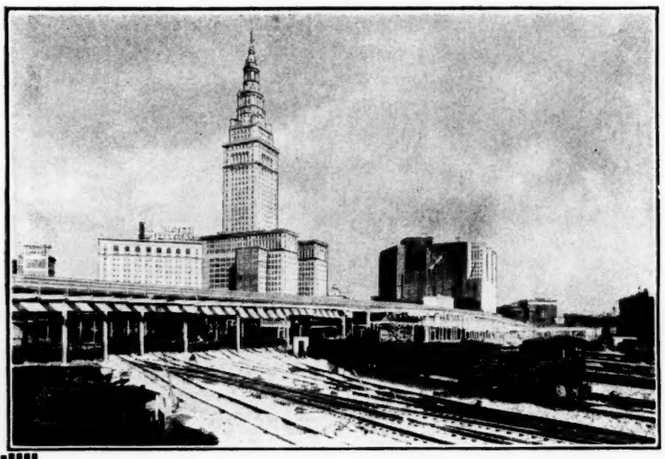
Title .....

Firm .....

Address .....

H-V

AIR-WAY ELECTRIC APPLIANCE CORP., Toledo, Ohio
HEATING SYSTEMS DIVISION



The Cleveland Union Terminal used 2642 lineal feet of Ric-wiL Cast Iron Conduit with Cast Iron Base Drain.

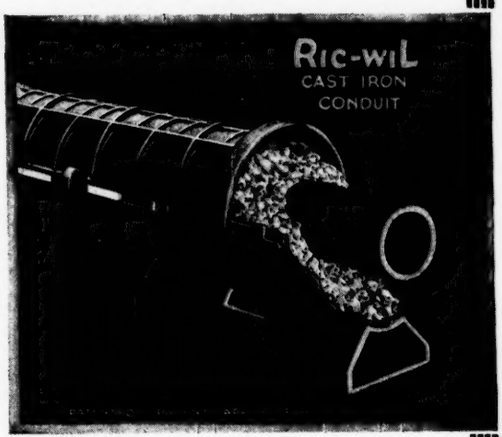
It holds up under extreme vibration and unusually heavy loads!

RIC-WIL CAST IRON CONDUIT *with* CAST IRON BASE

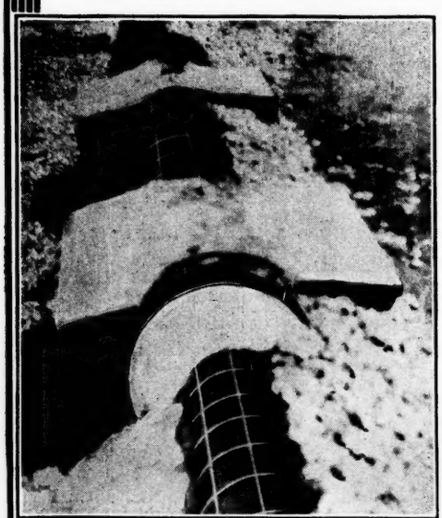
RIC-WIL Cast Iron Conduit, with Cast Iron Base Drain, gives absolute protection and insulation to steam pipes under or near railroad tracks. The design and materials provide more than ample strength for unusual loads and extreme vibration.

The Base Drain rests solidly on the trench bottom, supports and cradles the conduit and adds to its strength. The Conduit has both longitudinal and circumferential reinforcing ribs designed to give slightly under a load. The top and bottom sections lock together and are permanently sealed with the LOC-LIP Side Joint after pipes are installed. Pipe supports, resting on the base drain, are of heavy cast iron.

Insulation may be any of four types, but RIC-WIL DRY-PAC waterproof filler is by far the most effective. DRY-PAC stays firmly around the pipes regardless of vibration, and official tests of installed lines show from 92% to 94% efficiency.



Ric-wiL Cast Iron Conduit with Cast Iron Base Drain, showing locking clamps, Loc-liP Side Joint and Drypac insulation. Ric-wiL Cast Iron and Tile Conduits are interchangeable on either Cast Iron or Heavy Duty Tile Base Drain.



Union Terminal installation showing concrete alignment blocks and anchors at expansion joint, eliminating expensive manhole construction.

RIC-WIL Conduit, with RIC-WIL Base Drain, is quickly and economically installed. It eliminates much engineering, minimizes delay and the necessity of reinforced concrete field construction.. RIC-WIL engineers, with 20 years' experience, will be glad to help you solve any underground conduit problem. Feel free to write us at any time.

THE RIC-WIL COMPANY

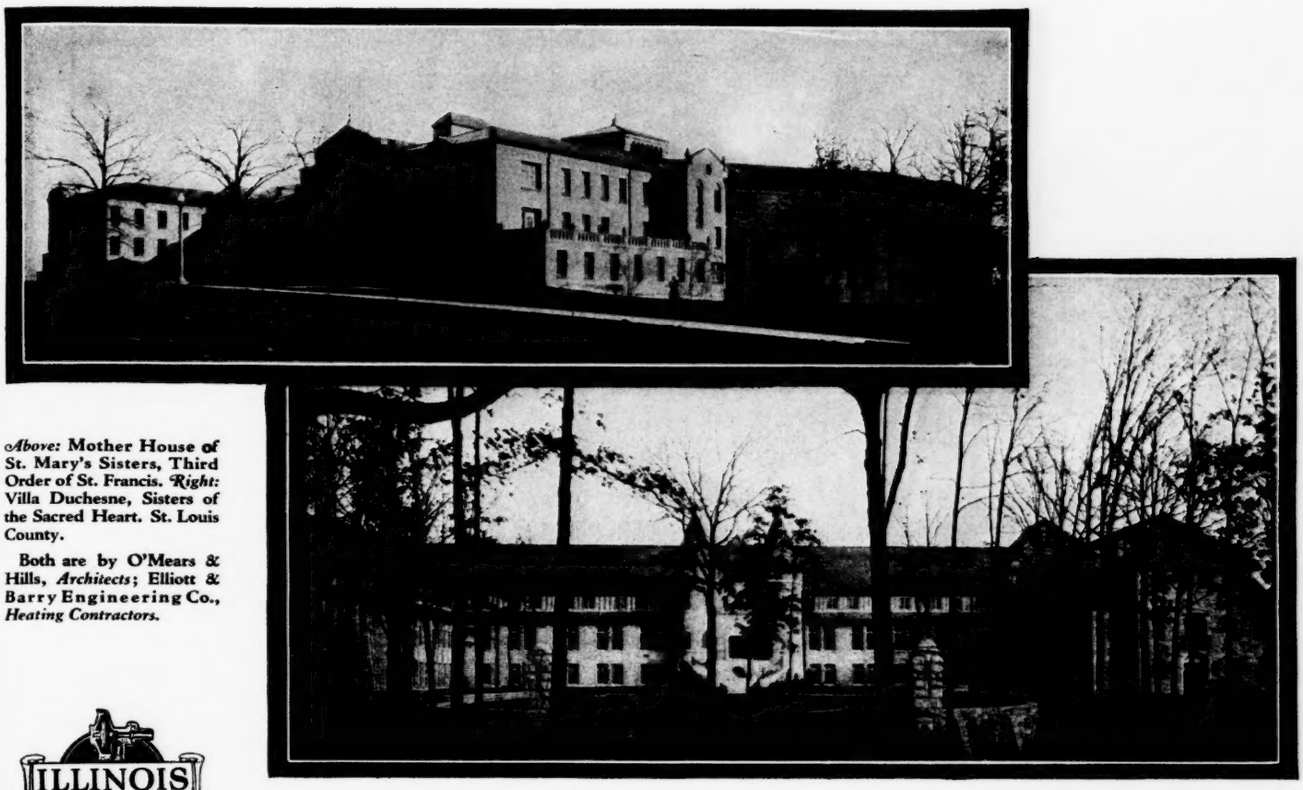
1574 Union Trust Building, Cleveland, Ohio

NEW YORK · ATLANTA · BOSTON · ST. LOUIS · BALTIMORE · CHICAGO

REGISTERED IN U. S. PATENT OFFICE

RIC-WIL

UNDERGROUND CONDUIT



Above: Mother House of St. Mary's Sisters, Third Order of St. Francis. *Right:* Villa Duchesne, Sisters of the Sacred Heart. St. Louis County.

Both are by O'Mears & Hills, *Architects*; Elliott & Barry Engineering Co., *Heating Contractors.*

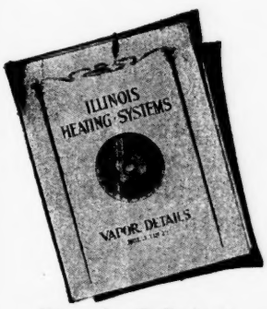
ILLINOIS HEATING SYSTEMS

ILLINOIS HEATING SYSTEMS

TO THE ARCHITECT, engineer, contractor, owner—ILLINOIS *Heating Systems* give complete satisfaction in every type of building. They combine the advantages of quick, positive steam circulation, easy control of room temperatures, noiseless operation, durability of apparatus, fuel economy [approximately one-third over ordinary systems], and a minimum of operating expense.

ILLINOIS *Systems* are balanced systems. All valves and specialties are of ILLINOIS manufacture and designed to operate as a unit. This offers great advantages over assembled systems made up of specialties of various manufacture and design. It also gives unified responsibility and guarantee.

The outstanding merit of ILLINOIS *Heating Systems* is further evinced by their selection for these two magnificent institutions in the vicinity of St. Louis.



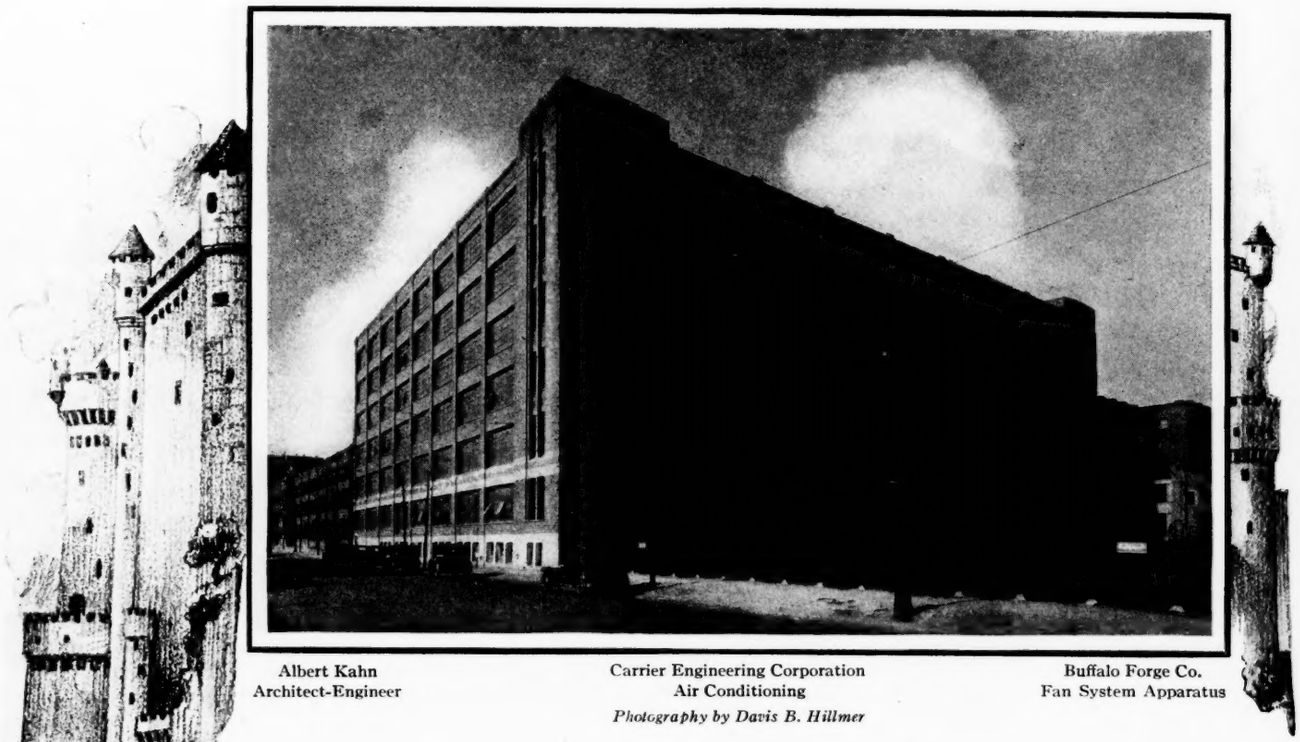
Write for Bulletin 22
AIA30c2 *Vapor Details*

REPRESENTATIVES IN 40 CITIES OF U.S.A.

ILLINOIS ENGINEERING COMPANY

ROBT. L. GIFFORD President INCORPORATED 1900

CHICAGO

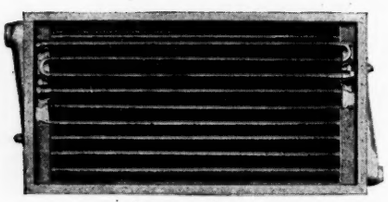


Albert Kahn
Architect-Engineer

Carrier Engineering Corporation
Air Conditioning
Photography by Davis B. Hillmer

Buffalo Forge Co.
Fan System Apparatus

—and now AEROFIN is helping Parke, Davis & Co. to build The Fortresses of Health



The Standardized Light-Weight Fan System Heat-Surface

4 Types **196 Standard Sizes**

Pressures up to 350 lbs. gauge.

Section illustrated is UNIVERSAL AEROFIN, 2½ to 200 lbs.

IN this newest Building of the great group comprising the Detroit Plant of Parke, Davis & Co., the world's largest makers of pharmaceutical and biological products, AEROFIN is the Heat-Surface,—as it is in an imposing number of the Master Buildings of the world, created by such Masters as Albert Kahn.

The reason will become obvious to anyone who investigates. The investigation may be made, easily and effectively, by asking Newark to send you Bulletin V-60, 128 Pages of useful Information and Data, including 28 proved Piping Diagrams in four colors, and large, readable Temperature Effect Charts on linen. Please use your business letterhead.

Any Office will gladly render prompt, efficient technical cooperation

AEROFIN
is sold only by Manufacturers of Nationally Advertised Fan System Apparatus.
List upon Request

AEROFIN CORPORATION

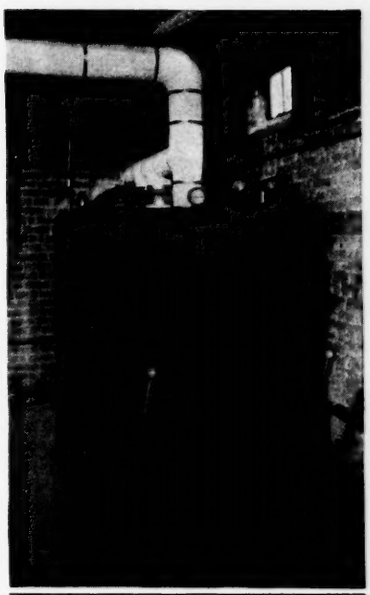
850 Frelinghuysen Avenue, NEWARK, N. J.
11 West 42nd Street, NEW YORK

Burnham Bldg. CHICAGO
Land Title Bldg. PHILADELPHIA
United Artists Building DETROIT
Oliver Bldg. PITTSBURGH
Paul Brown Bldg. ST. LOUIS

16 apartment building, 1257 E. 100th Street, Cleveland, Ohio. Heating Contractors, Garber Plumbing and Heating Co.

The heating contractor made his PROFIT at once . . . *and the owner got 47% on his investment EVERY YEAR*

Be sure to tell your prospects that they can have this equipment now and pay for it a little down and a little each month.



HERE is another example of the way a heating contractor gave an owner a big additional income and made a real profit for himself. This building was formerly heated by warm air, but the owner was sold the idea of installing an All-American heating plant—Redflash Boiler, Corto Radiation, Excelso Water Heater, Airid Air Valves and Arco Packless Valves.

The cost of the installation was $3050. The increase in rent was $1440 a year—or approximately 47% per year on the investment.

Mr. Grigsby, the owner, reports that now he has no trouble renting where before he always had from four to six apartments empty.

All around you are prospects like this. Show this advertisement to them and let them write to Mr. Grigsby if they would like to. His address is 18145 Lakeshore Blvd., Cleveland.

Have you listened to the American Radiator Birthday Party? It is on the air every Thursday night, 9 to 9:30, Eastern Daylight Saving Time over Station WEAF and affiliated stations of the National Broadcasting Company. It is real entertainment, and besides, it is telling your customers how to modernize their heating equipment.

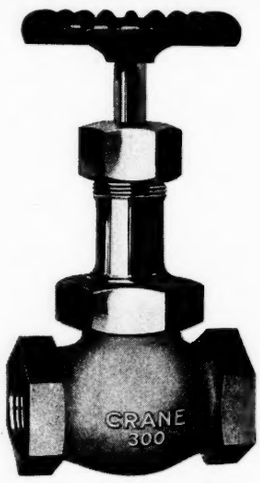
AMERICAN RADIATOR COMPANY

40 WEST 40th STREET, NEW YORK CITY

Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

1855 · SEVENTY-FIFTH ANNIVERSARY · 1930

The cost of keeping this valve tight for years is almost nothing



Crane brass globe valve, No. 362 E

The special hard metal disc in this No. 362 E brass globe valve makes it unusually efficient in controlling steam working pressures up to 300 pounds. For this disc is of an exceptionally fine brass alloy which years of experiment and service have proved capable of keeping the valve tight under the most severe conditions.

Increasing its serviceability is the union bonnet principle of this valve's assembly. This permits easy replacements and regrinding. The valve has an extra deep stuffing box and a brass gland; it can be repacked while under pressure.

In addition to such general service valves, Crane Co. manufactures a complete line of piping materials for all purposes, in brass, cast iron, malleable iron, ferrosteel, cast steel, and forged steel. For complete information concerning any valve and fitting for any purpose, get in touch with a Crane branch, or write Crane Co.

Valves CRANE *Fittings*

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO

NEW YORK OFFICES: 23 WEST 44TH STREET

Branches and Sales Offices in One Hundred and Ninety-four Cities

WING FEATHERWEIGHT

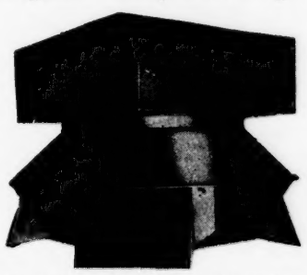
Summer is the Time for Modernizing Factory and Garage Heating

A BIG item in your summer business campaign is selling firms with old style equipment, up-to-date heating systems for their factories and garages. To interest these prospective customers, you must show them something definite, and convincing, a thoroughly modern installation like the Wing Heating System, scientifically designed to distribute heat evenly and to prevent the waste due to hot air banking up overhead.

No matter what the size or shape of their plant, or what the roof construction, a few Wing Featherweight Unit Heaters carefully placed and equipped with the proper discharge outlets will heat it comfortably. Installation costs will be very reasonable. Fuel cost will be remarkably low.

Wing Featherweight Unit Heaters are sturdily built, scientifically designed heaters, very light in weight and equipped with a highly efficient propeller type fan. They are placed right up under the roof or ceiling, out of the way, and discharge vertically downward from locations directly over the area heated. The discharge outlets distribute the warmed air in all required directions.

Type L C Unit with Regular 4-way Discharge



Wing Featherweight Type LC Unit with motor and fan beneath heating element, requiring minimum clearance to ceiling. Also used with fresh air duct.

You will find that these characteristics enable you to lay out an up-to-date heating system very efficiently and economically. Now is the time to write for detailed information.

L. J. Wing Mfg. Co.

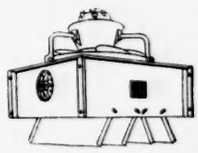
Manufacturers of Wing-Scruplex Propeller Fans and Exhausters, Wing Featherweight Unit Heaters, Wing-Scruplex Fog Eliminators, Wing Type E M Motor Driven Blowers, Wing Turbine and Centrifugal Turbine Blowers, and Wing Steam Turbines.

Dept. 6

158 W. 14th St., New York, N. Y.

"Heat with Unit Heaters"

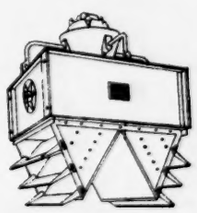
SOME DISCHARGES FOR TYPE H-C UNITS



Type HC Unit, with Vane Discharge No. 1. Motor and fan above heating element.

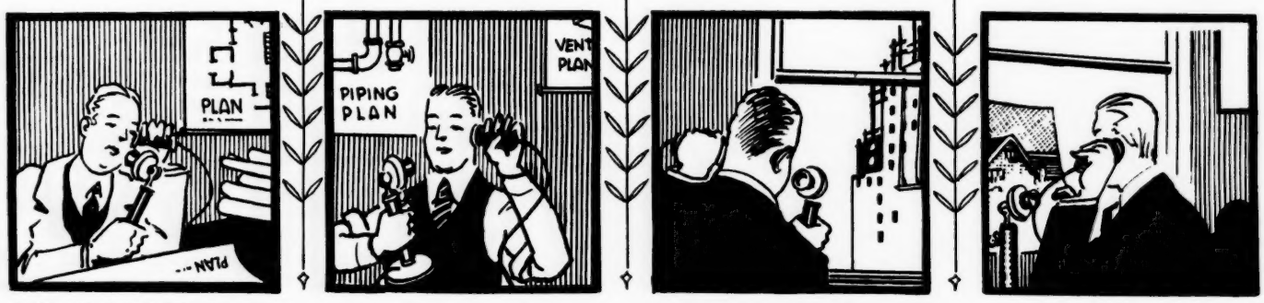
Moderate height, square areas.

Type HC with Discharge No. 5 Low positions—square areas.



Low—Long narrow areas.

UNIT HEATERS



ARCHITECT ENGINEER CONTRACTOR OWNER

THEY ALL DEMAND "QUALITY" in the HEATING SYSTEM

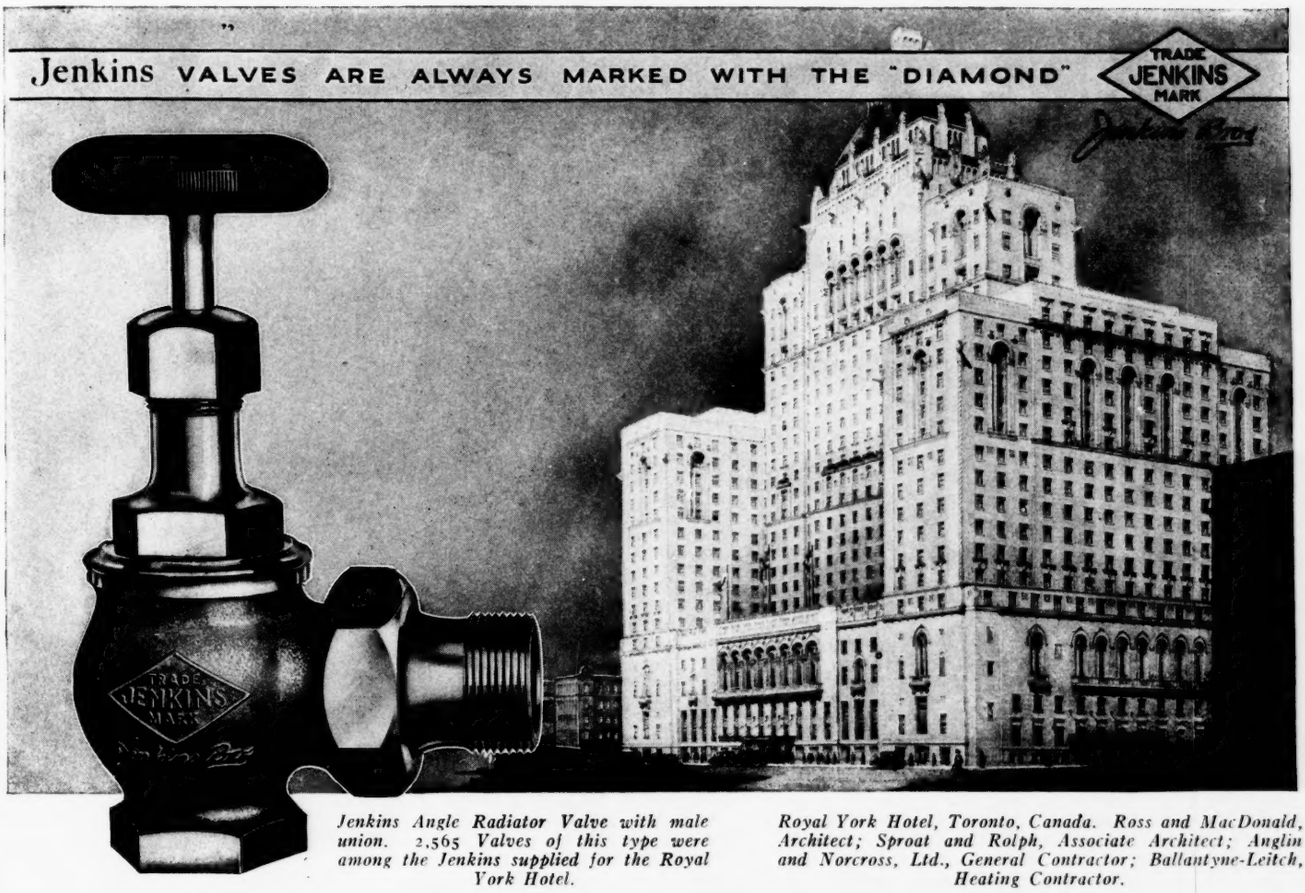
OUR thirty years' experience in the development and manufacture of heating appliances, plus hundreds of satisfied architects, engineers, heating contractors and owners, is the best guarantee of QUALITY in a Barnes & Jones Heating ... System! ...

BARNES & JONES
INCORPORATED
BOSTON MASSACHUSETTS

"The Sign B&J of Quality"

Quality Heating Systems

Vapor Modulation Vacuum



Jenkins Angle Radiator Valve with male union. 2,565 Valves of this type were among the Jenkins supplied for the Royal York Hotel.

Royal York Hotel, Toronto, Canada. Ross and MacDonald, Architect; Sproat and Rolph, Associate Architect; Anglin and Norcross, Ltd., General Contractor; Ballantyne-Leitch, Heating Contractor.

Contributing to guest comfort in 1,120 rooms

Correct room temperature is an important factor in modern hotel comfort, important, too, in holding the satisfaction of guests and assuring their return.

In the Royal York, Toronto, Can., the largest hotel in the British Empire, this factor of comfort was aided by the installation of Jenkins Radiator Valves in each of the 1,120 rooms.

The contractor who installs Jenkins adds the final touch of quality to good plumbing or heating. He completes a job that will serve, without servicing for many years . . . that will uphold the contractor's reputation and give economical operation. Jenkins are obtainable in bronze or iron for practically every purpose, through supply houses.

JENKINS BROS.

80 White Street, New York, N.Y. — 133 No. Seventh Street, Philadelphia, Pa.
524 Atlantic Avenue, Boston, Mass. — 646 Washington Boulevard, Chicago, Ill.
JENKINS BROS., Limited, Montreal, Canada; London, England
Factories. Bridgeport, Conn., Elizabeth, N. J.; Montreal, Canada

Jenkins
VALVES
Since 1864

The Flax-li-num

⟪ *Two-Air-Space* ⟫

Method of Application Means 50% more Effective Insulation . . .

The value of insulation to any home is in direct proportion to the amount of heat leakage it prevents . . . Plaster bases or sheathings do not provide adequate protection from heat and cold nor do they permit the heating plant to deliver full efficiency. This is especially true with automatic heating plants, either oil or gas. The home must be adequately insulated to assure economical operation.

FLAX-LI-NUM with two air spaces actually produces the greatest amount of insulation from an economical thickness of material. It is 50% more effective than a similar layer of insulation used as a plaster base or sheathing. According to the U. S. Bureau of Standards tests, ½ inch of FLAX-LI-NUM applied by this method is equal to more than ¾ of an inch at any other place in the wall.

When you recommend FLAX-LI-NUM with the two air spaces you have actually provided an "extra quarter inch of insulation" without charge. An "extra quarter inch" of comfort to keep a home more livable summer and winter alike . . . an "extra quarter inch" of economy to cut the fuel bills.

A complete book of specifications has been prepared for you, showing exactly how to insulate any type of home, so it receives the benefits of this "extra quarter inch" of insulation . . . showing how FLAX-LI-NUM slips between the studs easily and simply to form "two air spaces" . . . and telling you why FLAX-LI-NUM is semi-rigid in form. It is a valuable piece of literature for your files . . . May we send you a copy?

FLAX-LI-NUM INSULATING COMPANY
ST. PAUL MINNESOTA

FLAX-LI-NUM INSULATING CO., St. Paul, Minnesota HV-6
Send me complete information about Flax-li-num. Also facts about the "two-air-space" method.

Name .....

Address .....

City ..... State .....

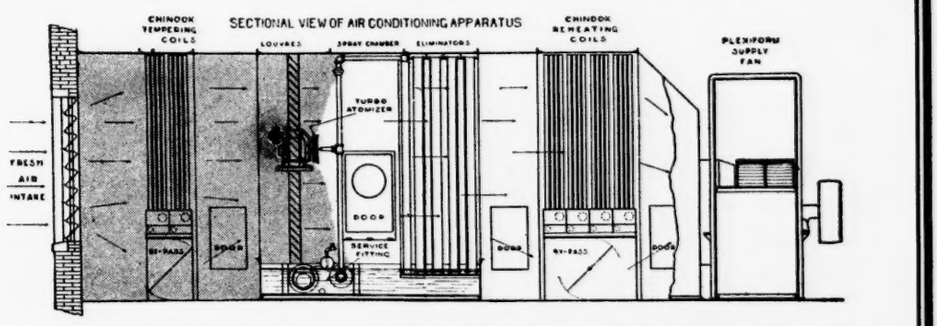
Flax-li-num
A CORRECT BUILDING INSULATION AND SOUND CONTROL MATERIAL

THIS AIR WASHER CANNOT CLOG! . . . .

Because it operates on a wholly different principle, the Bayley Turbo-Air Washer possesses these distinct and exclusive advantages:

—non clogging. No fine orifice nozzles to become clogged with entrained solids in the water and cause holes in the water screen.

—in place of a bank of fine orifice nozzles; a motor driven centrifugal water sprayer, delivering a water screen the equal of 100 ordinary spraying nozzles.



THE BAYLEY TURBO AIR WASHER

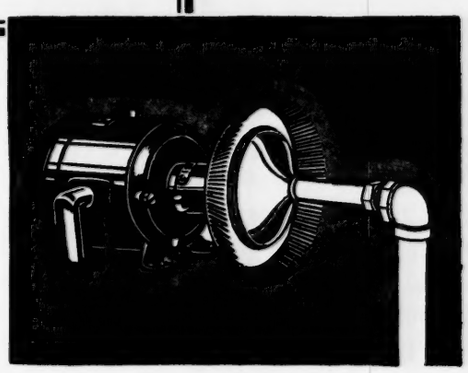
—a single fire type nozzle large enough to permit the passage of entrained solids in the washing water; thus allowing continued use of same water without the use of filters or strainers.

—a dense mist screen obtained by directing the water from the single nozzle to a rapidly revolving rotor where it is churned centrifugally into an even, solid spray.

—operates with water at only 7 ft. head at nozzle.

—by replacing multiple nozzle banks with Bayley Turbo-Atomizers present inefficient installations of air washers can be made highly efficient.

That briefly is the Bayley Turbo-Air Washer. Scores of installations have proven it successful. May we tell you where they are and describe them more fully by means of Bulletin No. 29A.



Above the Bayley Turbo-Atomizer. Plan illustration, shows complete Bayley Turbo-Air Washer.

BAYLEY BLOWER COMPANY

742 Greenbush Street, Milwaukee, Wisconsin

Fans — Heaters – Air Washers — Unit Heaters — Heating, Ventilating, Drying, Air Conditioning, Humidity Control, Mechanical Draft.

Bayley

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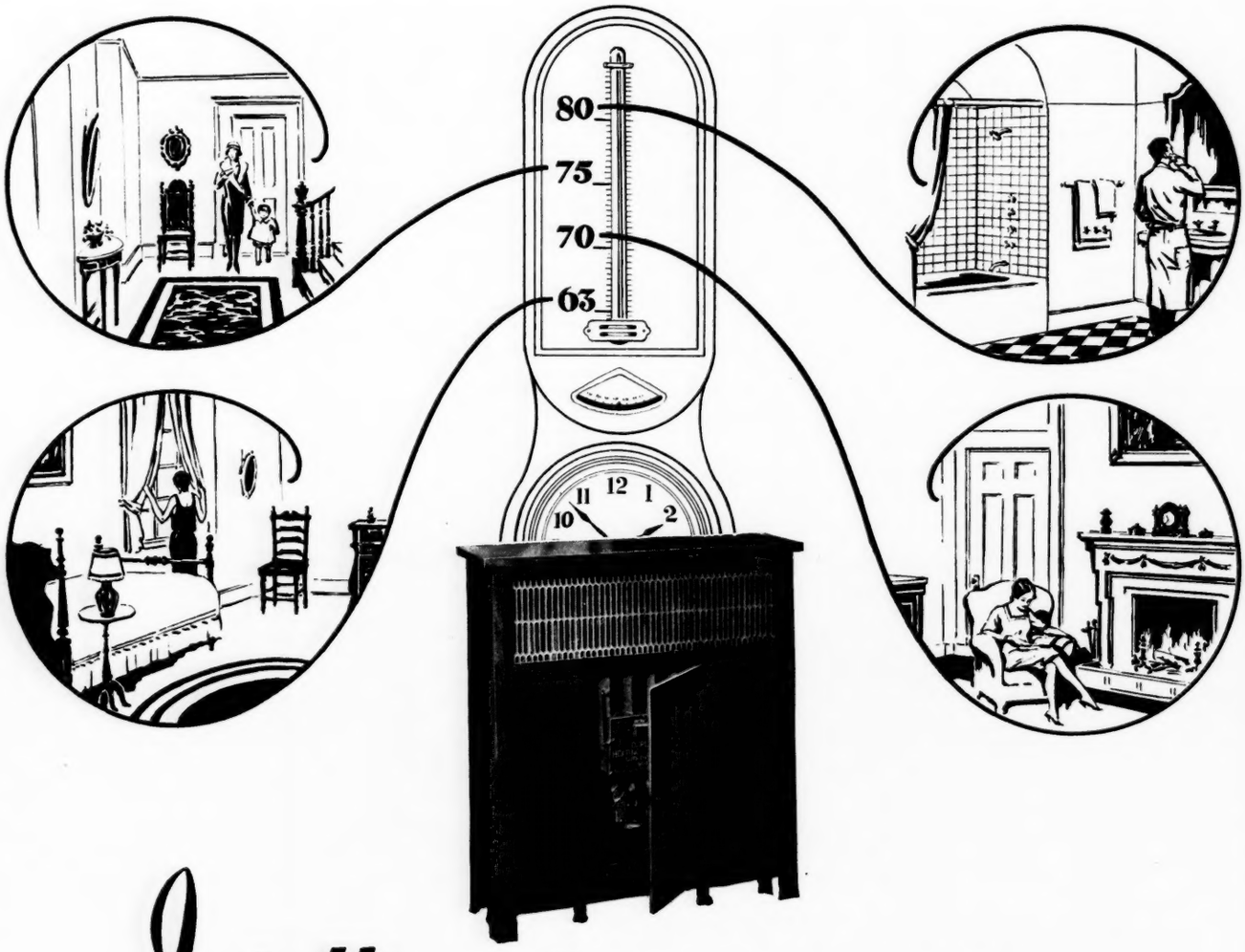

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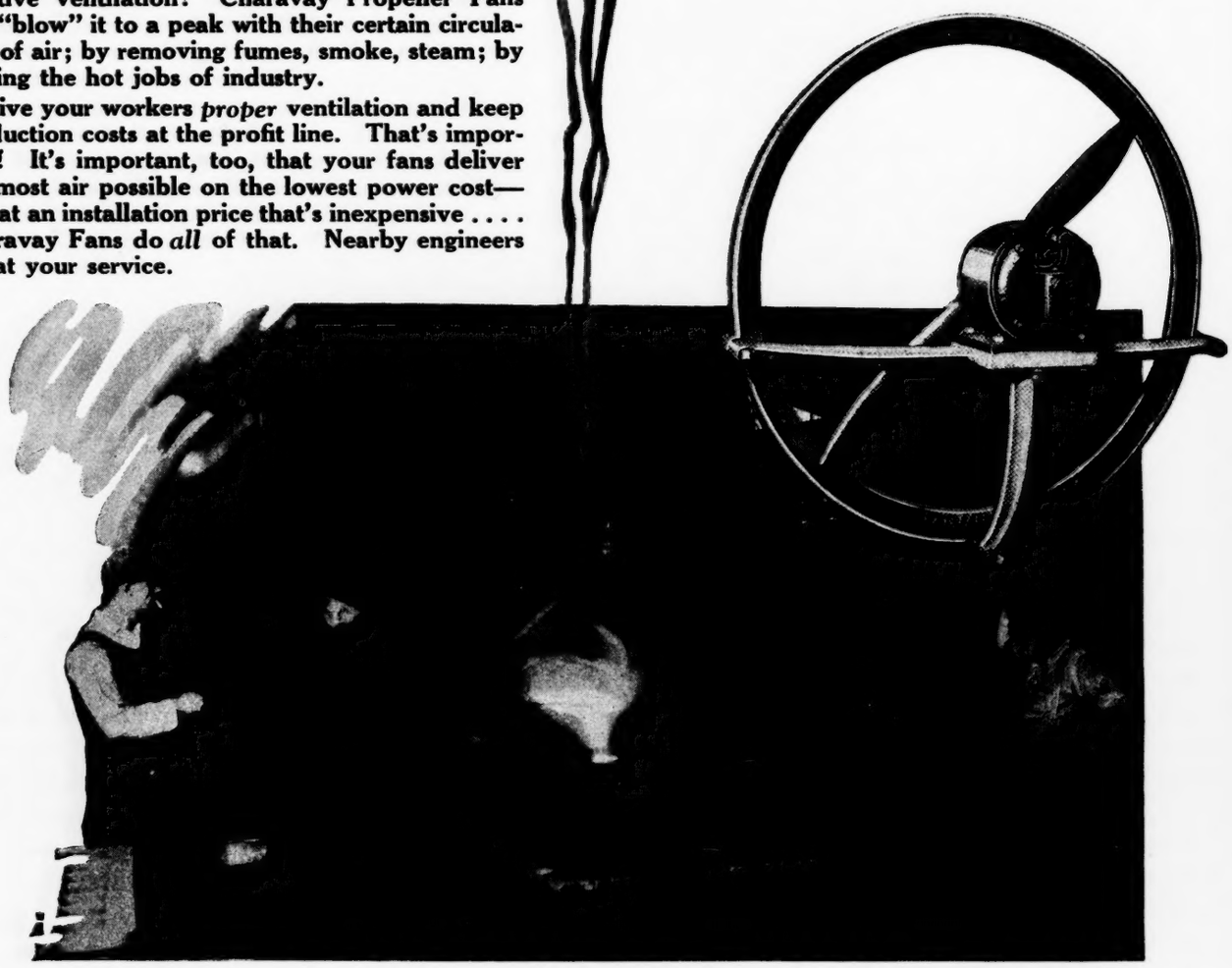

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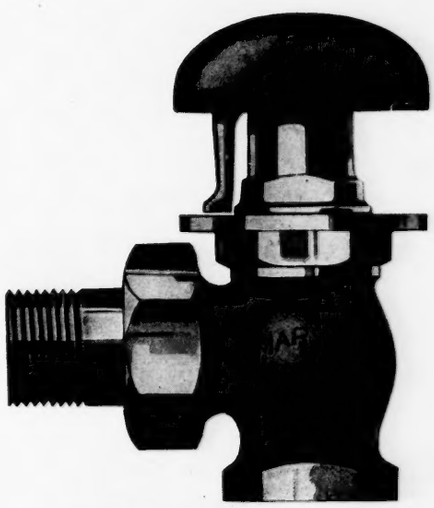

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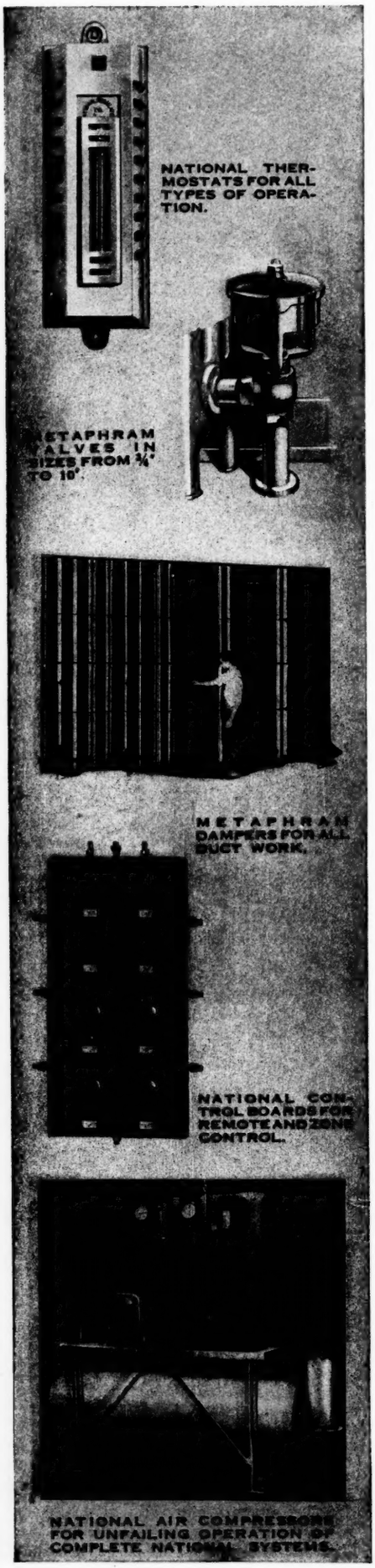
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A. S. Armagnac

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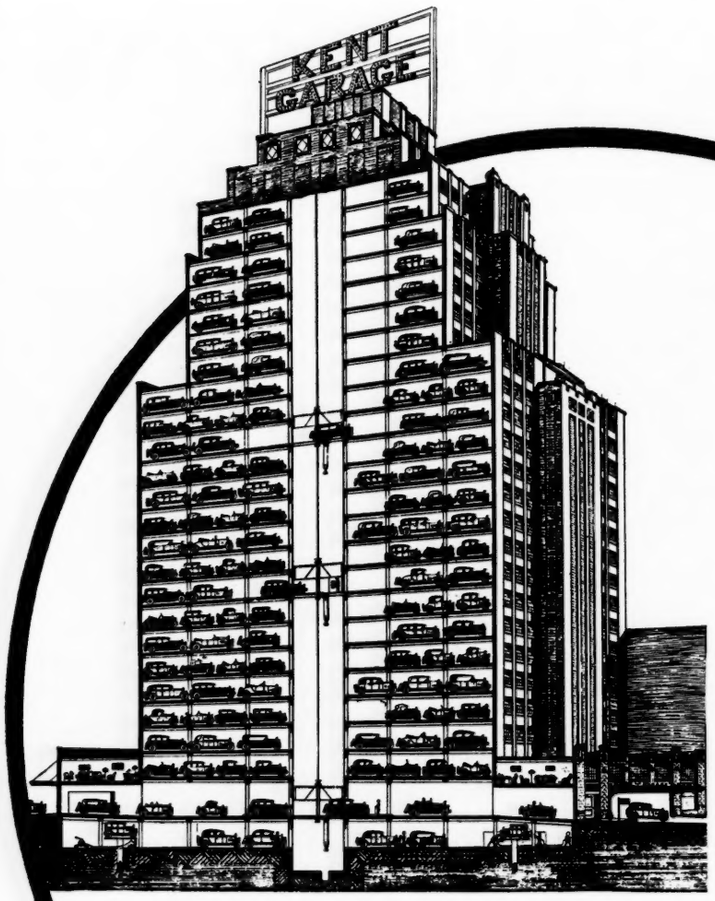

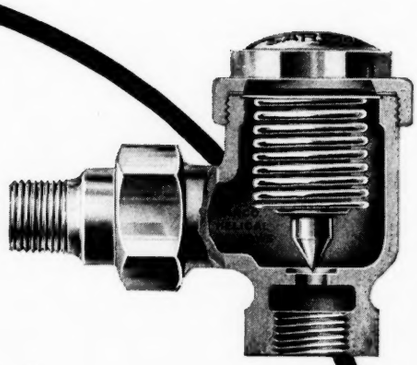

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HEATING AND VENTILATING

Editorial

AS engineers become more closely identified with the manufacturing end of industry there is grave danger that unconsciously they will become more or less commercialized and will find themselves extolling the merits of their products in ways that would never occur to them if they were entirely independent and open-minded. It is a curious psychological complex that manufacturers' engineers frequently become so thoroughly "sold" on their employers' products that their judgment actually becomes warped and leads them often beyond the bounds of sound engineering.

By reason of their knowledge of the intricacies of engineering, engineers are able to take advantage of the sometimes complicated reasoning involved in the explanation of given processes. For example, in comparing various fuels, by assuming a slightly lower CO_2 content in the flue gases for other fuels than those in which he is interested, an engineer can shave down their efficiencies. Again, in comparing fuel costs he can make some wonderful showings by increasing only slightly the average value of his own fuel and decreasing that of others. He can calculate fuel costs as averages for all parts of the country and select the slightly lower average for his own fuel and higher average for the more expensive grades. He can fail to mention that increased fuel consumption of a competing heating system is due partly, at least, to the maintenance of higher indoor temperatures than those obtained with his own system.

In most cases a careful study of such data will disclose to the reader any inaccuracies or misstatements which, intentionally or otherwise, unduly color the presentation. But in an art which is dependent on so many variables as heating and ventilating, very often it requires an alert engineering mind to discover the "nigger in the woodpile." When it comes to architects who can spend but a portion of their time in keeping abreast of the involved developments in heating and ventilating, they are placed at an unfortunate disadvantage which cannot fail to react eventually on the manufacturer.

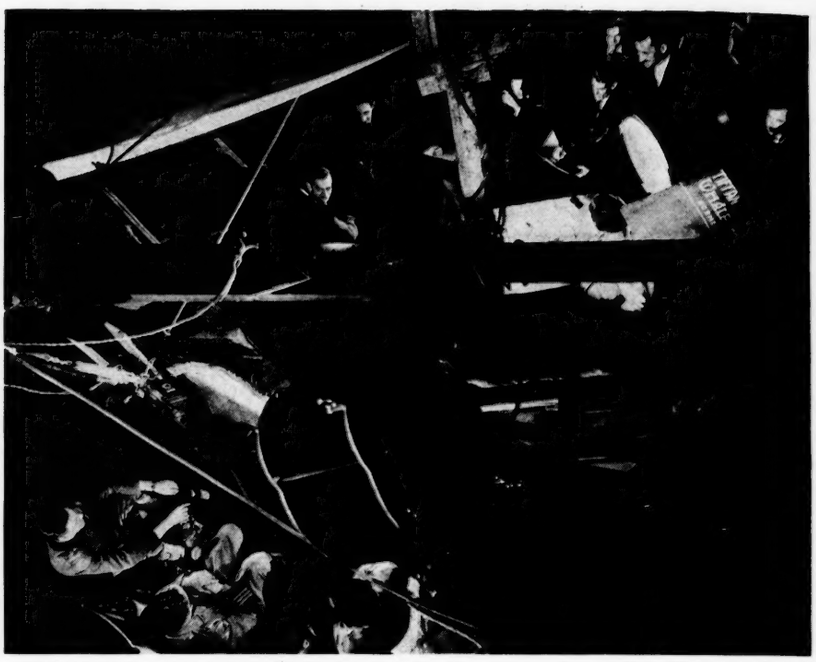
Any appliance or method worthy of being placed on the market undoubtedly has inherent advantages which the engineer can compare with those of competing products on a sound engineering basis without distorting the facts. Any other course only leads to disrepute and the worst of it is that the manufacturer may never learn the real reason for his failure to make the desired impression.

"IT'S an ill wind that blows nobody good." Now that talking motion pictures are the vogue, air movement and distribution have assumed a new importance in the motion picture studio. It has become necessary, for instance, to silence ventilating installations and to design systems for soundproof stages. Nowadays, it is common practice for two companies to be working on the same stage separated only by heavy sound-deadening curtains. Instead of frame and stucco sheds, it is not uncommon to find the new stages built of concrete and gypsum blocks or, if of frame construction, provided with double walls and so built that the entire stage is well insulated and as air tight as an ordinary refrigerator. Where the characters are smoking there must be absolutely no horizontal drafts on the stage. Again, in fire scenes, all exhaust must be towards the ceiling to take care of the smoke. To prevent movement of curtains, which frequently serve to depict the sky and distant landscapes, the air velocity at the supply grilles must be low. Due to varied uses of the floor space, air inlets must be located along the walls.

The importance of such data to the heating and ventilating engineer is obvious. At the same time the necessities of the studio in the way of air movement and distribution are furnishing some first-hand field data which can be applied to other interiors. It would be the irony of fate if the motion picture studios were to supply the answer to many of the ventilating engineer's problems.

JUNE this year upholds its reputation as the convention month. In addition to the meeting of the district heating engineers, which went on early in the month in St. Louis, the heating contractors are pointing for New York, where they will gather as an organization, from the 16th to the 19th, for the first time in forty years. Later in the month, from the 24th to the 27th, Minneapolis is to act as host of the A.S.H.V.E. while, at the same time, Boston is the stage for the convention and exposition of the National Association of Master Plumbers. It is an interesting fact that whereas, in former years, we looked upon compulsory ventilation laws, open-window ventilation and the like as the most pressing problems of the day, we now find interest centering in the problems of the heating contractor and in the measures which are being taken to solve them. Undoubtedly, important history will be made at the New York convention.

Heating and Ventilating Problems in Sound Picture Studios



Exhaust Grille's-Eye View of a Scene from "Journey's End," a Sound Picture by Tiffany Productions, Inc.

by **ROBERT L. STANLEY**

WE hear a great deal about the changes the new talking pictures have produced in the technique of the actor, how it has brought sudden prosperity to the song writer, thrown vast quantities of apparatus into the discard, created new problems and professions in the electrical industry and even added to the worries of diplomats. No one, however, has mentioned the mental gymnastics suddenly required of the heating and ventilating engineer when his profession was caught in the repercussion of this vast upheaval.

No doubt this change has affected the ventilation industry all over the country, owing to the necessary silencing of theatre installations when the change from silent to talking pictures was made, but we in Southern California had the additional problem of designing systems for the sound proof stages, and, in so doing, coping with a lot of suddenly developed conditions peculiar to this industry alone. To the credit of the engineers doing this work it may be said that the results have been almost universally satisfactory.

In order to better explain the difficulties encountered it will be necessary to turn back a couple of years and describe the method of making silent pictures then in vogue.

Picture studios of that date usually consisted of from two to ten stages, in connection with a group of dressing rooms, administration buildings, etc. These stages were in reality nothing but great barn-like frame and stucco sheds, varying in width from 50 ft. to 100 ft. and from 100 ft. to 200 ft. long. The studdings were usually exposed and the roof sheeting formed the ceiling which was usually from 35 ft. to 40 ft. above the floor. A large number of huge sliding doors were placed at intervals around the walls. From two to five or six companies might be making pictures simultaneously upon one stage, separated only by low canvas curtains, or by the flimsy walls of the scenery, or sets.

In most stages, the only heating was done by a number of portable coke-burning salamanders placed at convenient intervals. While ventilation was provided by sheet metal ventilators in the roof, fresh air entered through a partly open door or doors at some unoccupied portion of the stage.

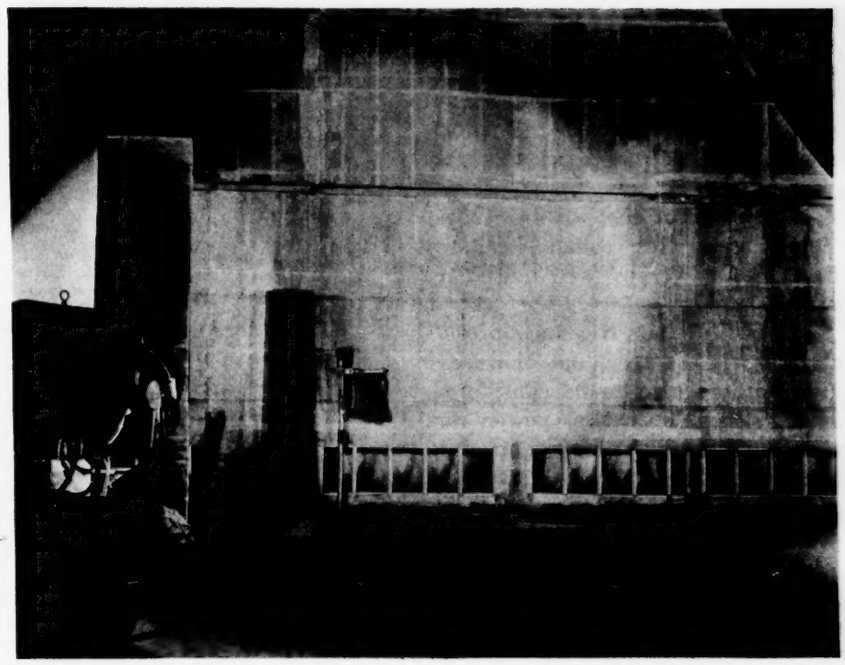
New stages, while like the old ones in general design, are radically different in detail. In order to prevent a confusion of sounds which would be unavoidable were a number of companies working on a single large stage as of old, the new stages are built slightly smaller, or are divided by partitions, and are nearly always occupied by only a single company. In case two companies should be working upon the same stage, they are separated by heavy sound-deadening curtains which may not be disturbed or passed through under any circumstances during action. These curtains are movable and may divide the stage into any number of sections of any required size.

Instead of being flimsy sheds, the new stages are sometimes constructed of concrete and gypsum blocks or, if of frame construction, are provided with double walls, with a space of approximately 18 in. between the inner and outer walls, with the inner walls lined with rock wool or some other sound deadening substance. The

ceilings are constructed in much the same manner, so that if one wishes to enter or leave, one must pass through an inner and outer door, both of them sound proof and air tight. In other words, the entire stage is as well insulated and as air tight as an ordinary refrigerator.

Since nearly all the mob scenes, and occasional fire scenes accompanied by heavy smoke, are taken in this air-tight box, and since lights totaling many thousands of candlepower are adding their quota of heat, and since the stages are closed tight for hours at a time, it is easily seen that a real ventilation system is required.

It is one thing to calculate what the ventilation requirements are but quite another to meet these requirements when faced with the difficulties this installation must overcome. Here, for example, are a few points which the engineer must take into consideration when designing a heating and ventilation system for a sound proof stage.



Air Inlets in Wall Insulated for Sound; the Rock Wool Is Held in Place by Wire Netting

Let us suppose the hero to be sitting in the library idly blowing smoke rings toward the ceiling. Now consider what the effect would be were these rings to be quickly dissipated to right or left instead of sailing lazily upward. Within a few days after the preview letters would come pouring in calling attention to this fatal error, and wanting to know what kind of imbeciles were responsible for the stage management of our present day pictures. This brings us to point number one. *There must be absolutely no horizontal drafts on the stage.*

Next consider the smoke from a burning room on the second floor of a building and what the effect would be if this smoke were drawn towards the floor. Point number two, then, is that *all exhaust must be towards the ceiling.*

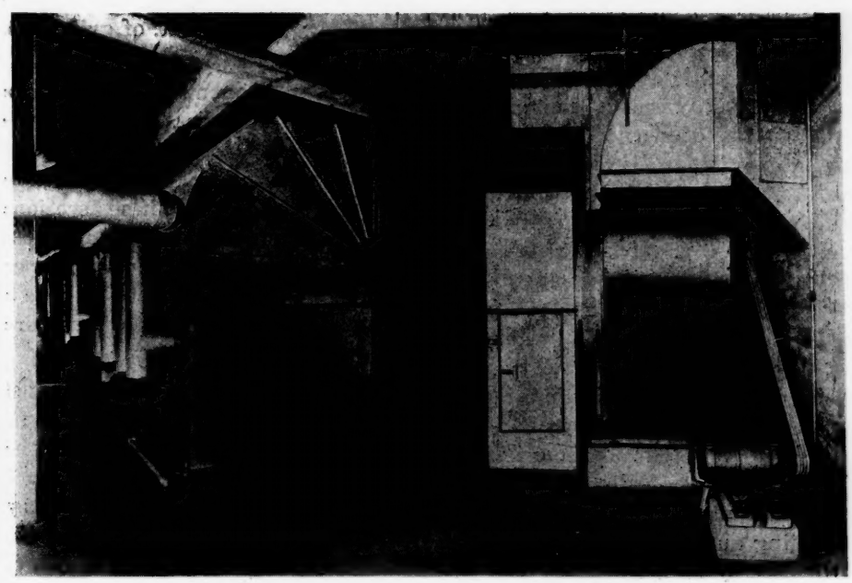
The sky and distant landscapes are frequently represented by a blue muslin or canvas curtain which surrounds the set, and which often extends 25 ft. above the floor.

This curtain answers its purpose only so long as it is absolutely motionless. At the least waving, the illusion of distance is lost, and since these curtains are usually located near the walls and would surely be in motion were they in contact with any strong blast of air, we can understand the reason for point number three—*the velocity at the supply grilles must be very low.*

Logical methods of admitting air under the conditions outlined above would be through a large number of registers or mushrooms in the floor, but here again we meet with difficulties. Any point on the floor may, and probably will, at some time or other, be covered by a rug or dance floor or it may be used for a flower bed. Therefore, point number four is that *the air supply must be admitted along the walls.*

Another point to consider is that while at times the heat generated on the stage itself may be very great, at other times only two or three scantily clad people may be working in the entire building. Consequently, point number five is that *in such cases it is necessary to heat as well as ventilate the stage.*

Since we have reached the conclusion that the air must be admitted along the walls at a low velocity and that the exhaust must be overhead, we can see at once point number six—that *the exhaust must be in the center of the room.* Otherwise, when delivering warm air, there would be



Battery of Three Heavy-Duty Gas Furnaces with Exhaust Blower at Right

a short circuit upward along the wall between the supply and exhaust grilles.

Point number seven, and one of paramount importance, is the definite requirement that *the entire plant, including both the supply and exhaust systems, must be absolutely noiseless.* This necessitates sound insulated ducts, sound traps and low duct velocities.

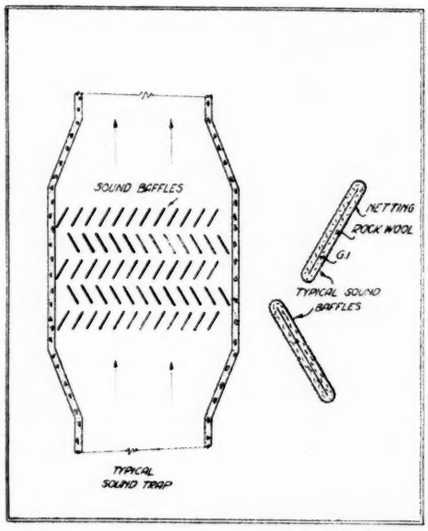
The seven points listed are of outstanding importance, but there are many others also to be considered, among them, acoustics, power and fuel consumption, time required to heat or ventilate the building, and the first cost of the system.

When designing a system for such a building, the engineer is compelled to cast aside all thought of incorporating any pet ideas of his own and to break away from old methods which have proven successful in the past. He must obtain his results by steering clear of a great array of "Thou shalt nots" over which he has no control and which beset him on every side.

An example of what can be done under these circumstances is the heating and ventilating system in operation in the four sound proof stages of the Tiffany Productions, Inc., (Tiffany-Stahl) in Hollywood, Calif. This installation has been in use for a sufficient period of time to demonstrate amply its ability to cope with all kinds of weather, and is proving satisfactory in every way, providing ample ventilation in summer, maintaining a temperature of 65° F. in the coldest local weather and doing this without noise or objectionable drafts.

Stages are of the double wall frame construction described previously. All have an average ceiling height of 35 ft. but vary in area covered. The largest, stage number three, is 18 ft. wide by 131 ft. long, while stages number one and number two are the smallest, each of them being 66 ft. by 81 ft.

The first requirement given consideration in designing this system was that of flexibility. A little investigation disclosed the fact that the load on the system might vary anywhere from 1 hr. or 2 hrs. use per day on the smallest stage to 24 hrs. per day at maximum capacity on all four stages. Furthermore, owing to their various uses, one stage might need cooling while its neighbor might be in need of heat.



Detail of Sound Trap and Sound Baffle

Obviously, then, separate systems for each stage formed the best answer to this problem. It was found, however, that the increased efficiency gained by operating separate systems for the two smaller stages did not justify the increased first cost of such an installation. Stages number one and number two therefore are cared for by a single plant consisting of air washer, supply blower, exhaust blower and heating apparatus, capable of providing 40,000 C.F.M. or approximately 6 air changes per hour, while stages number three and number four are each cared for by a similar installation.

Next to be considered was the type of heating apparatus to be installed and once more the question of flexibility played a large part in the decision made. To meet varying requirements, this apparatus must operate efficiently when delivering a small volume of heat or when operating at maximum capacity. Furthermore, it must reach this maximum within a short period of time and must cool as quickly. These conditions are met by welded, ingot iron gas-fired furnaces which were accordingly incorporated in the system.

For various reasons, it was thought best to house the various units of the system at a single central point. Consequently, an apparatus room of sufficient size was accordingly excavated under a building which houses the recording and projection rooms, and the entire system, excepting two exhaust blowers, is installed in this space, together with a smaller gas-fired heating and ventilating plant for the recording rooms, which will be discussed later.

Supply ducts for the stages, and the exhaust from stage number four, were carried under the buildings and across two paved alleys in concrete ducts which had been heavily coated on the inside with pitch.

As the construction of the various ducts plays a large part in the sound proofing of the system it will be well to describe this point in detail, using stage number three as an illustration, as it is largely typical of the entire group.

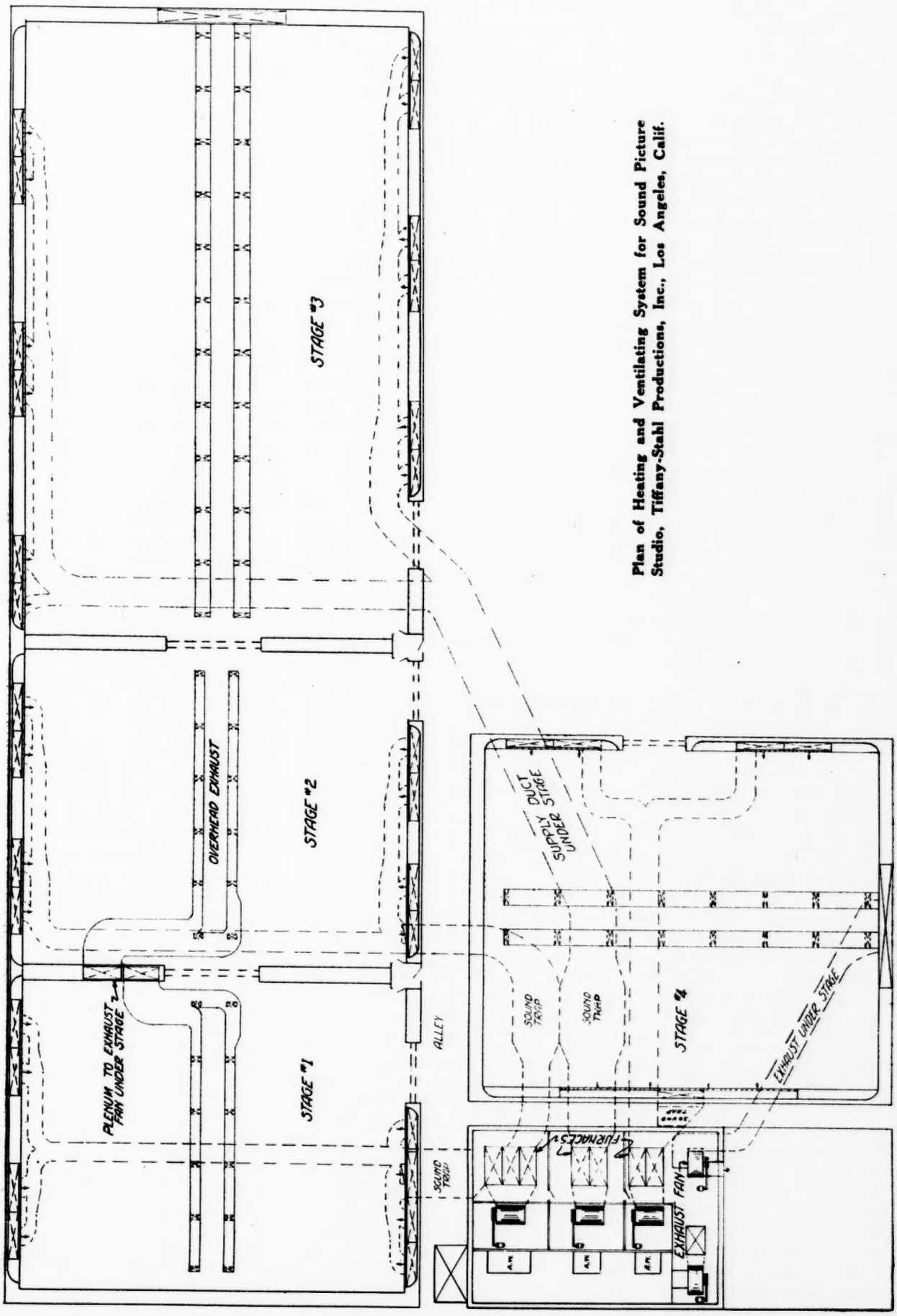
In order to prevent any obnoxious air currents on the stage, or air noise in ducts, the velocity of air travel was carefully considered and a grille velocity of 250 ft. per min. decided upon. Experiments showed that this velocity would neither produce noticeable air currents, nor disturb hangings, unless they were within 2 or 3 ft. of the grille. An even rate of air flow over the face of the grille was obtained by using a low throat velocity, in this case 350 ft. per min.

Obviously, when using an overhead exhaust and a low inlet velocity, any warm air introduced would have a tendency to rise immediately above the zone of occupation, unless the point of entrance were close to the floor, about 24 in. being the maximum efficient height to the top of the grille. With 40,000 C.F.M. supply at 250 ft. per min. velocity we have a net grille area of 160 sq. ft., or a gross area of 200 sq. ft., which made a total length of 100 ft. of grille 2 ft. wide.

In order economically to obtain this length, certain sections of the space between the inner and outer walls were boxed in and connected to the supply ducts. These sections open to the stage through an almost continuous line of grilles. Proper deflectors were installed to provide a uniform air delivery along the entire section.

Branch ducts are of galvanized iron designed for a velocity of 500 ft. per min. All bends are lined on the outside radius with approximately 1 in. of rock wool, held in place by poultry netting of about 1-in. mesh.

Of concrete, the main duct is smooth finished inside, with bends lined with rock wool as previously



Plan of Heating and Ventilating System for Sound Picture Studio, Tiffany-Stahl Productions, Inc., Los Angeles, Calif.

described. This duct was designed for a velocity of 800 ft. per min. with the exception of the sound trap, for which a 500 ft. per min. velocity was calculated.

These sound traps deserve a special paragraph as they are new to many in the heating and ventilating business. The fundamental idea of these traps is to break up and absorb all sound waves in a stream of air by impingement of the air against cushions of some soft material. Naturally, the only way to secure the impingement of the entire air volume is by dividing the air into a number of small streams. Experience has taught that a number of these sound deadening contacts must be made in succession before all noise is eliminated, the number being governed largely by the sound volume at the primary end of the air stream.

It is obviously impractical to set these sound absorbing cushions or sound baffles at right angles to the air flow. The writer has found that an angle of 30° to the line of flow gives the best results, while there seems to be little difference whether the baffles are set herringbone fashion or in continuous zigzag lines. The material from which the entire sound trap is constructed also does not appear to be of great importance so long as a proper lining has been provided and the trap is not too close to the source of noise. Great care must be taken, however, to provide a cushioning material which will not give off lint and gradually disintegrate under the constant flow of air.

In this particular installation the sound trap is a chamber cast in the concrete duct and provided with a number of rows of vertical sound baffles, each one constructed of galvanized iron and covered with approximately 1 in. of rock wool, held in place by 1 in. mesh poultry netting.

Exhaust ducts are carried overhead for the entire length of the building with a number of inlets along the sides. These inlets were designed to operate at a velocity of 300 ft. per min., the branches at 300 ft. per min., and the main ducts at 500 ft. per min. These ducts were joined to a plenum chamber formed by blocking off the ends of a space between the inner and outer walls of the stage. The chamber extends from its junction with the overhead duct to the floor lines where a connection is made to a galvanized iron duct running to the exhaust blower.

Soundproofing on the exhaust ducts is handled differently from that on the supply ducts. No sound traps are used and but little sound deadening is supplied on the inside of the ducts. The only precaution taken to prevent sound following back was the lining of the galvanized duct with rock wool near the blower. Although few precautions were required to prevent the sound of the blower traveling back against the air flow, it was still necessary to insulate the outside of the overhead ducts for an entirely different reason—to obtain perfect acoustics.

It seems that the microphones used in the talking pictures are so sensitive that the least deviation from a clear cut tone, even one too small to be noted by the human ear, is magnified many times on the record and interferes seriously with the reception when thrown on the theatre screen. The infinitely small disturbance caused by sounds striking against metal ducts overhead and reflected down to the floor again is more than enough to ruin a sound production. Therefore insulation on the outside of these overhead ducts became as much a necessity as was inside insulation on the supply ducts.

The exhaust blower is located under the floor of the stage and is not enclosed in any way, the only soundproofing being a small area of rock wool insulation directly above it. A slow speed blower is used and the motor is of a very quiet type. A standard make of V-belt drive was provided.

Fresh air is taken through a louvre about 20 ft. above the ground and drawn downward to the basement in a vertical shaft 8 ft. by 12 ft. This shaft is enlarged at the bottom to form a room 11 ft. by 42 ft., 12 ft. in height.

Three air washers are installed in this room, each washer set close against and connected to an opening in a dividing partition which separates it from an individual fan room containing its corresponding blower.

Stage number three can also be used as a typical example of the operation of this part of the system. Air from the washer is drawn through the wall opening into the fan room. No direct connection is made between the washer and the blower, which is of the down blast type. The discharge from the fan passes in a concrete duct under a wall, which divides the fan room from the furnace room, thence under a battery of furnaces and upward through the furnaces into the supply duct leading to the stages.

The projection and recording building requires an unusually quiet system, especially between floors, as it is necessary to guard against the travel of noise from one room where a violin may be playing soft music to another room where a jazz band might be recording. This requires an insulation of rock wool inside of all ducts in addition to the sound trap; also a second insulation on the outside. The ducts carry the air into the recording rooms through mushrooms under seats on a raised platform, low velocities being used as in the stage installation.

For this building the supply blower is located in the furnace room and draws its supply of air from the common shaft through a tight connection discharging into and through a single furnace in the same manner as used in the stage systems. No air washer is provided for this system.

Located on the roof, the exhaust fan discharges directly into the atmosphere. Great care was taken in designing the base for this unit in order that no vibration can be communicated to the building. All exhaust ducts are carefully insulated inside to prevent sound transmission from one room to another.

A second exhaust fan is also located on the roof, exhausting air from two projection booths with ducts connected directly to projection machines as well as to grilles in ceilings.

Ten heavy duty gas furnaces, with a combined net delivery of 3,000,000 B.T.U. per hr., were used in the system. In all, nine blowers were used, most of them driven by variable speed motors.

Installation was made by the Lakin Corporation of Los Angeles.

Equipment

Gas-fired furnaces—Payne Furnace & Supply Co., Inc., Beverly Hills, Calif.
Air washers and grilles—Lakin Corp., Los Angeles, Calif.
Exhaust and supply blowers—American Blower Corp., Detroit, Mich.
Motors—Sterling Motor Co., Los Angeles, Calif.
Fan drive—Texrope, Allis Chalmers Co., Milwaukee, Wis.

Air Conditioning

I—Preamble

by **WILLIAM HULL STANGLE and HENRY WARREN KINGSBURY**

WE human beings living on the face of this planet of ours, the Earth, move about in a gaseous fluid which we call air, just as fish move about in the liquid fluid, water. In both of these fluids is found a chemical which is absolutely essential to the support of Life. This substance is known chemically as oxygen. In the case of the fish, the oxygen which is entrained in the water in a free state is removed from the water by the gills of the fish. The gills form a sort of filter allowing the water to pass through and retain the oxygen which in turn is absorbed by the life stream of blood and carried through the body of the fish to do its work.

In the case of the human being the air is inhaled through the nostrils or mouth into the lungs and the oxygen in the air is filtered out and absorbed by the life stream of blood and carried through the body to do its work.

It is estimated that about 4% of free oxygen is contained in water under normal conditions. If we are to accept the Darwinian Theory, and the more recent history of the world by H. G. Wells, we must admit that the fish has adapted itself to these normal conditions and that his respiratory organs have developed with the rest of his system to gain the greatest advantage of the conditions under which he lives. Since these normal conditions have existed for ages it can be seen that a deficiency in the oxygen content or an over abundance of this necessary element would cause him either discomfort or death. A deficiency would result in an insufficient supply of oxygen and would fast result in discomfort, then illness and, if continued or the deficiency be marked, would result in asphyxiation.

On the other hand, an over abundance of oxygen would tend to increase the amount passing through the gills and in turn cause over oxidation. If the over abundance were considerable, it would cause an actual burning of the tissues, resulting in death.

When a fish is taken from the water it suffocates because the oxygen content of the air is too high and the moisture content too low. A human being drowns because the oxygen content is too low and the water content too high.

This analogy of the "poor fish" is akin to the conditions under which the human being exists.

There are three classes of components of the air. Those of the first class are oxygen, nitrogen and argon, and the inert gases of the helium family. Three components are in the air in almost constant proportions. Those components of the second class are variable in quantity. They include carbon dioxide, water vapor and dust. Those components of the third class are accidental and include such obnoxious gases as sulphur dioxide, ammonia, illuminating gas and the like.

Of these components we are particularly interested in those of the first class and partially interested in those of the second class. The components which are constant in amount, namely those of the first class, have quite accurately been determined. For all practical purposes it is safe to assume that there is 21.00% oxygen, 78.06% nitrogen and 0.94% argon.

Wherein the gills of the fish were protected to a great measure by the water in which the oxygen was dissolved, so the oxygen in the air is prevented from burning the lungs by the presence of the inert gas nitrogen. If there is a deficiency of oxygen it will result in discomfort and if the deficiency is marked death will result. Conversely, an over abundance of oxygen results in discomfort and, if marked, causes death.

Of the gaseous components which are variable in amount we find that pure country air contains about three parts in 10,000 of carbon dioxide. In city air there are from six to seven parts in 10,000, while in auditoriums, where ventilation is defective, the proportion may be as high as fifty parts in 10,000.

Sources of carbon dioxide are numerous. It may result from the decay of vegetable and animal matter, or by the combustion of coal, wood, oil or other fuel. It is produced in the human body by the oxidation of the carbon in the food which we eat and is exhaled by all living animals, including human beings.

The proportion of carbon dioxide in the air naturally would increase continuously were it not for the fact that it is removed as rapidly as it is produced by the action of growing plants wherein the leaves of the plants use the carbon dioxide as a food, exhaling oxygen back into the atmosphere. In other words, plant life does exactly the opposite to animal life, thereby maintaining a perfect balance in the nature of things.

Air will sustain life under certain conditions to a point of 10% carbon dioxide.

Moisture in the air is referred to as relative humidity. The standard is the quantity required to saturate the air at a given temperature. When the air is saturated the relative humidity is said to be 100%. When the partial pressure of the water vapor present is one-half that of water at the same temperature the

relative humidity is 50%. The average relative humidity of the atmosphere is about 66%. On a moist day the atmosphere is heavy or oppressive and the atmospheric pressure is below the average. Moist air is lighter than dry air because the molecular weight of water is 18 whereas that of oxygen and nitrogen is 32 and 28, respectively.

Discomfort caused by humidity is due mostly to a physical condition of the human body.

Digested food in the life stream of blood is oxidized, producing what is known as an exothermic chemical reaction resulting in the liberation of heat. But our bodies must remain at a constant temperature of 98.6° F. A rise of a few tenths of a degree will produce discomfort. Some of the heat is lost by radiation from the skin, but the major adjustment results from the evaporation of water through the skin.

Oppressive feelings in a humid atmosphere are due to the air being too nearly saturated, preventing the proper evaporation from the body and causing heat from the body to accumulate. So the relative humidity of an atmosphere is the measure of the correct condition of the air in a room.

In the winter season cold air, which is relatively dry, infiltrates into the room and is heated. Its relative humidity consequently is very low; evaporation is too rapid and results in discomfort. In the summer season the outer air usually is nearly saturated at room temperature and, unless there is a rapid change of air, the moisture from the body increases the humidity, resulting in discomfort from a cause opposite to that of the winter season.

It is well to note that a fixed layer of air lies close to the surface of the human body. This quickly reaches body temperature and becomes saturated. The water vapor must leave this layer to make room for more water vapor coming from the body. This can only be done by diffusion, which can best be produced by a more rapid movement of air in the room, but in no case should it be so great as to create drafts.

The more ancient theory advanced for the unhealthiness of poorly-ventilated rooms was based on the supposed accumulation of carbon dioxide from the breath. Tests have shown that the proportion rarely is sufficient to produce harmful vitiation.

Ventilation and air conditioning, therefore, are more a study to supply fresh outside air, to keep it in constant motion, maintain a proper temperature, and a humidity that will give the greatest comfort to the occupant.

We have all observed a beam of sunlight in a dark room and noted the light reflected from the particles of dust in the air. The dust is partly inorganic, consisting of clay, limestone and soot. In industrial centers the dust may consist of particles of cement, steel, glass or other substances kindred to the products of the local industries. The other part of the dust is made up of coal dust, street refuse, shreds of textiles, hay, straw and the like and are termed dead, while the living dust consists of pollen, spores, bacteria and other microscopic organisms. Some of the bacteria are disease-producing germs.

Natural soil contains about 100,000 micro-organisms per cubic centimeter, unfiltered river water from 6,000 to 20,000 micro-organisms per cubic centimeter, while *pure* air contains only four or five micro-organisms in 1,000 cubic centimeters. On the other hand, air in congested areas is laden with dust and the following are the number of dust particles in 1 c.c. of air.

Outside, raining	32,000
Outside, fair	130,000
A room	1,860,000
A room near the ceiling	5,420,000
Air above Bunsen flame	30,000,000

Air is a mixture and not a chemical compound. It must not be considered as a single chemical substance made up of nitrogen, oxygen and argon with carbon dioxide, water vapor and dust in solution.

In addition to the inert gas (argon) there are minute traces of helium, neon, krypton, xenon and niton, all part of the helium family, but their presence is so minute as to be inconsequential in this discussion.

Knowledge of Physics and Chemistry Essential

We are so accustomed to modern miracles that we are likely to accept them without question. We are flying through the air in airplanes, driving automobiles at nearly 200 mi. per hr., crossing the Atlantic in a few days in palatial ocean greyhounds, crawling beneath the surface of the sea in submarines, travelling underground in electrically-driven subway trains, mounting tall buildings in high-speed elevators. By the mere touching of a button we can switch on electric lights and labor-saving devices. We can send communications in a few moments around the earth by telegraph, telephone or radio Last, but not least, we can manufacture and perfect synthetic atmospheres in which to work or play in comfort. All of this is possible and understandable through the agency of that science called physics, and that sister science called chemistry.

Physics is defined as the science which treats of matter and energy. It is also defined as that branch of science which deals with the physical changes in matter of which the freezing and evaporation of water, the breaking up of substances and the like are examples.

Matter. Anything that occupies space is called matter. As an example, water is matter; when it freezes it is ice but still the same matter since there is only a physical change and there is no chemical change. By the same token water can be evaporated by heating to form a gaseous fluid called steam.

All matter is either a solid or a fluid. Fluids may be either liquid or gaseous. Solids have a definite volume and a definite shape. Liquids have a definite volume but take the shape of the containing vessel. Gases have neither a definite volume nor a definite shape; they not only take the shape of the containing vessel, but expand or fill the vessel irrespective of its volume. A liquid that flows freely is said to be mobile, while a sluggish liquid is said to be viscous.

Matter is indestructible, it can be changed physically or chemically and by proper treatment be brought back to its original state. This is called the law of conservation of matter.

All matter has certain specific properties. Since matter occupies space it must have volume, that is, it must have length, breadth and thickness. The fluids, liquids and gases also have volume but have the additional property of extension because of their fluidity.

(To be continued)

Panel Heating in the British Embassy

II

by **ALFRED L. JAROS, Jr., and RICHARD A. WOLFF**

EXCEPT for a few unimportant attic rooms, which are heated with radiators, the entire Embassy Building is heated by the panel system, with hot-water circulated from a central boiler plant. The plant also furnishes all domestic hot-water and steam for heating the other buildings of the group. (For motives of economy in first cost, the Chancery Building and garage are heated with exposed steam radiators.)

The boiler plant is located under the rear wing of the embassy, and contains two large steel boilers, fired with fuel oil. Steam from these is piped directly (through an underground tile conduit) to the Chancery Building and to the garage. Steam from the same boilers is supplied to converters of the cast-iron shell and copper water-tube type (similar in all respects to those used in or forced hot-water plants), which are located adjacent to the boiler room and are thermostatically controlled to maintain the water temperature continuously at any desired point. according to weather requirements. Motor-driven centrifugal circulating-pumps of standard type, which are provided in duplicate (as are the heaters) circulate the heated water to and from all the panel coils in the embassy.

Steam Coil Hot Water Tanks

In the same space also are located domestic hot-water tanks of the steam-coil type which supply the hot-water requirements of the embassy. The returns from all these hot-water converters and heaters,—and from the smaller steam-heated buildings, —are handled by vacuum - return pumps of standard type which deliver all such returns back to the boilers.

The central plant is quite standard in all respects other than those already mentioned, such as character of the piping materials, the chimney and boiler smoke-connections, non-conducting covering, etc. It has a total capacity of 175 boiler H.P., or an equivalent capacity of about 22,000 sq. ft. of standard radiation. The actual load carried in the most severe weather, with the building fully occupied and used, will be about 125 H.P., each of the boilers being large enough, so that one will suffice during the larger part of the heating season.

Heating Coils and Pipes

As previously stated, practically all portions of the embassy itself are heated by the panel system. All coils and concealed piping are made of extra-heavy steel pipe, put together entirely by welding (of the electric type, in the case of factory-made coils, and of autogenous type, for all field connections). The piping system, generally, is arranged with overhead supply mains, down-feed supply and return risers, and return mains run in the basement and in trenches and underground spaces.

All risers are concealed in chases and in furred spaces in the walls. Radiator branches (whose vertical portions are run in the same spaces with the risers) run horizontally either *in* the floor slab, or in ceiling or other similar spaces, to suit the individual conditions.

In order to avoid all difficulties of adjustment, a special effort was made so to design the piping system as automatically to secure a balanced condition of flow, in respect of all the various scattered coils (numbering 204 in the aggregate) of the panel heating system. The scheme employed, was:

a. The use of a down-feed system (which also is required for proper venting).

b. The layout of the flow mains and return mains in such a manner as to give an approximately equal length of travel from the pumps and heaters to and from each individual coil in the system.

c. The layout of the piping, as far as possible, with bends, rather than fittings (which was made easy by the fact that it was welded).

d. The size and frictional resistance of all sections of the piping were carefully calculated and adjusted in the design to secure such balance.

The results have been entirely successful. No adjustment or throttling of the system has been found in any way necessary. After the system has been properly filled, a thoroughly balanced circulation is secured through all portions of it.

About 75% of the coils are cast in the bottom of the concrete slabs. A few (about 10%) are cast in the floors, or in side-wall panels, to meet special conditions at doorways, entrance corridors, and rooms whose floors rest upon the earth or upon unheated spaces. The balance (about 15%) of the coils are located in hung ceilings, which (except for this) are similar in construction, in every way, to other hung ceilings commonly used in this country.

Installation

The usual method of procedure was as follows:

a. The coil, if small, was delivered to the job in a completely fabricated condition (in the case of the larger coils, two or more sections were delivered to the job, and joined by welding after erection).

b. Prior to erection, the coils were treated and tested at the factory to make sure of absolute freedom, both from leaks and from any internal

obstructions that could retard the water circulation. (In passing, it might be noted that only a very small percentage of the coils were found initially to be obstructed. In the completed job, every coil apparently is clear and unobstructed.)

c. The coils to be cast in the bottom of concrete slabs were erected in place, and accurately leveled up before the forms for the concrete were erected.

d. Such connecting pipe work as would not be accessible after the concrete was poured also was erected, welded, and tested before the forms were erected.

e. The reinforcing rods or mesh for the concrete were put in place, the concrete was poured, allowed to set, and the forms stripped, in the usual way.

f. At this point the coils, in some cases, were visible, the middle of the pipe just showing through the bottom of the slab (flush with the concrete). In other cases, a skin of cement had penetrated below the pipes, which actually were invisible, but could faintly be traced by a slightly different color and texture of the concrete at these points.

g. At a much later stage in the construction of the building, the plastering work was done. The rough plaster was erected in the usual way. For the "white coat," the special plaster previously referred to was carefully applied and trowelled on. The scrim reinforcement was applied at once to the wet surface of the plaster and worked up into it with the trowel until completely embedded in the finished plaster. As a matter of uniform finish, the *entire* ceiling was reinforced with scrim, in all rooms where any ceiling coils made such reinforcement necessary for a part of the ceiling.

h. Before applying any heat the plaster was allowed to set and dry out, after which (the other portions of the job, meanwhile, having reached a sufficient state of completeness) the system was filled with water, vented clear of air, and water was circulated, at first, at a low temperature, which gradually was raised as the plaster dried out.

In the case of the coils in hung ceilings, the procedure generally was similar to that above outlined. An important difference was that the coils were not erected until after the slabs had been poured and the forms stripped. The whole coil structure was tied into the adjacent metal lath construction and suitable insulation was laid on top of the pipes to prevent any considerable amount of heat from passing upward, and to confine the heat as much as possible to the ceiling itself.

The rough coat of plaster was trowelled up forcibly through the lath, so as to secure an intimate bond between the plaster and the pipes of the coils. Both the plaster itself and its reinforcement were exactly as described in the previous paragraph. Needless to say, all pipework of any kind running in the hung ceiling spaces was installed, welded, and tested before the lath and plaster went up.

Fig. 2, showing in detail the layout of ceiling coils and connections for one of the principal rooms, is of particular interest as indicating the adaptability of the coil-layout to rooms in which an elaborate "coffered" ceiling is provided. All of these coils are in the hung ceiling construction, they are located at three different levels because of the ceiling design, and their connections run both at these and at still higher levels, in some cases. Actually, the installation for this room afforded no greater technical difficulties than in the simplest cases.

Fig. 3 shows this room in a nearly finished condition, — and it will be noted that the elaborate ceiling shows no trace of the heating equipment which it conceals. (It might be mentioned, in passing, that the exposure and heating requirements of this room necessitated the provision of a considerably greater area of heating panels, in proportion to the total area of the room, than is commonly required.)

Special care in the design and careful arrangement of levels and pitching of the individual branches make possible the thorough venting of all coils when filling the system, and the complete draining of all coils when the system is emptied.

In this building the layout of coils was adapted readily to other peculiar ceiling conditions, such as a coil forming a curved surface instead of a flat plane for installation in a "barrelled" ceiling (with the requirement, of course, in this case, that the supply branch connects to the highest point and the return branch to the lowest point of the coil, so as to secure proper filling, emptying, and venting).

Around entrances and in certain rooms having peculiar conditions of exposure that might chill the floors, coils are located under the floor, so as to make the finished floor a heating panel. These coils were not set until late in the progress of the job and offered no peculiar problems except that they had to be embodied solidly in cement (forming a bed for the marble, terrazza, or tile). In certain other cases, to meet similar special conditions, coils were located in portions of the side walls. At these points, 4-in. recesses were pro-

Figs. 5 and 6 (opposite) Views in Servants' Appearance of one of

vided in the brick walls. After the coils had been erected, connected, and tested, forms were applied to these recesses and the entire recesses filled with concrete.

Fig. 4 shows the interior of Bedroom No. 7 (referred to hereinafter in connection with tests of the heating). It will be observed that Fig. 4 has been marked up to indicate the location of the coils in the ceiling, while the photograph if unretouched would show nothing but the finished plaster, as actually it appears to the eye. Fig. 5 shows various small coils in place, in the corridors and small rooms of the Servants' Wing, while Fig. 6 shows one of the completed rooms in the same area, again emphasizing the complete concealment of the heating equipment in the finished room.

In practice, the entire piping system of the building (with negligible exceptions) was assembled by welding. This applies to the mains and risers just as much as to the coils and branches. Generally speaking no fittings were used in the mains, the openings for the riser branches being cut and the pipe joined entirely by the use of the welder's torch. There is in this, of course, nothing that is peculiar to panel heating, but it is an interesting detail of the heating work in this building.

Figs. 7 and 8 show various views of some of the more interesting welded connections and of the actual work of installing this piping. In the boiler room, in the steam-heated Chancery Building and in certain very accessible portions of the attic of the main building, ordinary steel pipe and screwed cast-iron fittings were used.

Operating Experience and Tests

The plant has been operating, and was used for temporary heating durthe winter of 1929-30. During this period, there were several brief but exceptionally cold spells of weather in Washington. During these periods, however, no difficulty was experienced in maintaining comfortable conditions throughout the building, in spite of the fact that plaster was being dried out, that there were various openings not yet closed with doors and that (even in the more finished rooms) the windows and doors lacked all molding, weatherstrips, etc.

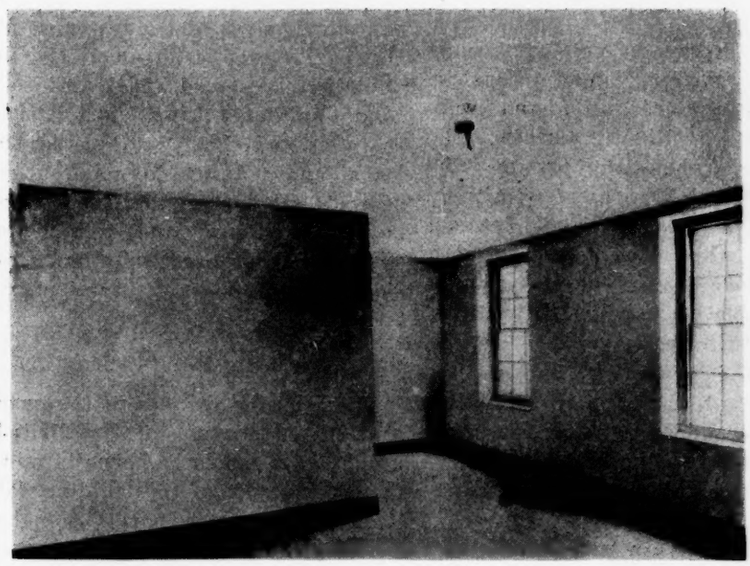
Owing to these conditions it has not yet been possible to make any tests of operating economy, but very interesting tests have been made as to the heating effect of the panel system in its relation to the comfort of occupants.

On a 40° day, with an average water temperature of 115° F. in the coils, careful tests were made of the air temperature, sensations of comfort or discomfort, etc., in a number of rooms (including two bedrooms, the kitchen, and the servants' hall). These rooms were selected because they had ample outdoor surface through which to lose heat, because all of them were so located as not to be warmed by the sun at the time of the tests, and because all of them were in a sufficiently-advanced state of completion so that the plaster was fairly well dried out.

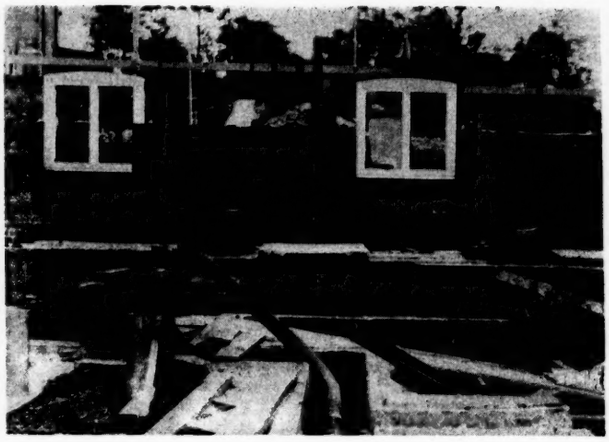
Conditions were adjusted to maintain, in one of the rooms tested, an average air temperature between 59° and 60° F. In the next room an average air temperature between 62° and 63° F. In the kitchen, about the same air temperature, and, in the servants' hall, an air temperature of 66° F. In all cases, these temperatures represent the reading of an accurate thermometer whirled in the air in the middle of the room (so as to get as true an air temperature as possible, with a minimum of absorption of direct radiant heat by the thermometer bulb). As a check, readings were taken with the thermometer held still, close to the floor and at a level about 2 ft. above the floor in each room. It was found that the temperature at the floor was in all cases from 1° to 2° higher than the air temperature (as would be expected from the theory of panel heating).

The consensus of opinion of several observers, in each case, was that substantially comfortable conditions were experienced in the room maintained at or slightly below 60° F., that *complete* comfort was experienced in the rooms maintained at about 62° F. and that a sensation of serious overheating was experienced in the room maintained at 66° F. All of the observers were men, dressed in ordinary clothing, without hats or overcoats. Several of those in a 62° room were quite convinced that the temperature was approximately 70° until they were shown the thermometer.

An interesting result was in the kitchen, which had the same air temperature and which gave equally comfortable sensations as the bedroom illustrated. The kitchen has a ceiling height of about 20 ft., with all the heating coils located in the ceiling. It was selected as one of the test rooms to verify that the radiant heat could maintain equal comfort, even when coming from so considerable a height above the floor. In the other rooms tested, the ceiling height varied between 10 and 12 ft. Of course, the comfort sensation of different observers will vary somewhat, but the tests seem to establish that with only the moderate temperature of 115° in the coils, one can be equally comfortable *in a panel-heated room,*



Wing, Showing Location of Panels and the the Finished Rooms



Figs. 7 and 8. British Embassy Buildings During Construction, Showing Welded Piping

at air temperatures at least 6° lower than commonly thought necessary in a room heated by the usual convection methods.

One notable detail of these tests was that the air in the rooms tested felt slightly cooler when one walked briskly through the room than when standing still, a result entirely consistent with the theory that the comfort experienced in the relatively cool air was due to the direct "pick-up" of radiant heat by the body and clothes. Brisk movement does not change the amount of radiant heat picked up, but, by creating an appreciable velocity of the relatively cool air in contact with the body, it somewhat increases the absorption of heat *from* the body. This should partly counteract the common tendency to become overheated by dancing, or by any other exertion. It is a well-known physiological fact that slight variations in the "effective temperature" to which the body is subjected have a tonic and stimulating effect, and this result of panel heating seems to provide such an effect just at the time (when exerting oneself) when it is most valuable. Conversely, whereas ordinarily one who has been exerting himself may feel chilly upon sitting down or lying down, with panel heating, as soon as he is still, it feels as if the air temperature had slightly been increased.

A striking and somewhat unexpected result of the tests made was the sense of discomfort experienced at 66° F. This was sufficient to leave no doubt in the minds of those conducting the test that the normal temperature of comfort with *panel heating*, must be kept appreciably lower than 66°.

Special Advantages of Panel Heating

Panel heating, as used in the British Embassy, has the following distinctive advantages:

(a) No heating equipment is visible in the finished rooms, thus permitting the utmost freedom of architectural treatment, decoration, the free use of French doors and of window seats, and allowing complete freedom in the placing and arranging of drapes and furniture.

(b) There are no pipes, grilles, or radiators in sight and there are no rising air currents from such sources to blacken or discolor walls or drapes.

(c) The amount of heat delivered can be regulated to suit the weather requirements and the wishes of the occupants, in the same way as with other hot-water systems, thus permitting the maximum of comfort and the minimum of fuel consumption.

(d) Still greater comfort results from the combination of a low air temperature with mild and well-distributed radiant warmth; the lower air temperature prevents the stuffiness and dryness so commonly felt in well-heated rooms in cold weather, while the radiant warmth from above keeps one delightfully comfortable (even when sitting near an open window).

(e) The lower air temperature results in a higher relative humidity, which is not only more healthful, but conduces to the better preservation of fine woodwork, pictures, and the like.

(f) The low air temperature materially reduces the heat losses from the building; and this (in combination with the convenient adjustment of the water temperature to suit the weather) results in economy of fuel consumption. (With an average winter temperature of from 35° to 40° F., a room temperature of about 62°, which is apparently the most comfortable with panel heating, would result in heat losses which, on the average, would be only about 75% as great as those from rooms heated to 70°).

(g) In high rooms still more economy will be gained by the fact that the heat is radiated downward, thus avoiding the "blanket" of very warm air at the ceiling, which commonly occurs in high rooms heated by convection.

(h) From the standpoint of maintenance, the panel heating system is about as simple and durable as any conceivable central heating system. Outside of the boiler plant, there is literally nothing but steel pipes, a few hand-valves and a few pipe fittings. As practically all of the installation is welded and tested to a high pressure after installation, there is practically no chance of leaks, and nothing to get "out-of-order." Of course, the same water is circulated over and over again, so that there is practically no corrosion, even after many years' use.

Installation Costs

In discussing the cost of the panel heating installation in the British Embassy, it should be borne in mind that only a part of the building (although the larger part) is panel heated. However, to be more instructive, the comparison of the cost of this system with that of an ordinary

heating system has been worked out on the basis of the *entire building* as a panel-heated installation. Not only the cost of the heating installation itself, but also that of any special structural requirements and special finishes (such as radiator enclosures, on one hand, and special plastering, on the other) must be considered since, from the standpoint of a building owner, obviously it is the effect of panel heating upon the entire cost of the building that counts, and not only the heating contract.

In the case of the Embassy, the actual installation cost was affected to a considerable extent by the fact that it was the first installation of its kind in this country. On the basis of the experience gained here, as to the best methods of handling such an operation, we have *recalculated* the cost as we would estimate it today for a new and similar installation. We have preferred to use these figures (rather, than the misleading ones derived from the actual cost in the first job) in what follows, so as to give as true a comparison as possible of the difference in cost for the two systems.

The entire Embassy group (including the Chancery) has been figured both ways in the comparison that follows, which gives a close, present-day estimate, for a panel-heated job, on one hand, and a high-grade vacuum steam system, on the other. If heated with steam, these buildings would require approximately 300 radiators, aggregating approximately 10,000 sq. ft. of equivalent direct radiation. The number of public and well-finished masters' rooms is such that approximately half of the radiators would have to be enclosed (involving additional radiation, metal linings, non-conducting covering, and grilles under the heating contract, and also cabinet work for the enclosures, provided under another contract). In the case of a steam heating plant, it would also be necessary to provide temporary connections for a large number of radiators, in order to carry on work during cold weather and to dry out the building (which temporary connections are not required with panel heating).

On the other hand, in addition to the heating contract, the estimate for panel-heating (in order to afford a worthwhile comparison) includes an additional item (based on actual experience) for the additional cost of the special plastering work required for the heating panels. No additional cost has been allowed in connection with any other part of the building work, although, at first glance, it might seem that some extra cost would be entailed in the form work and pouring of concrete. Actually the savings made possible for the builder, in the later stages of the building, are at least sufficient to cancel any such item.

On the basis above given, the cost of a steam-heated installation has been figured as follows:

Oil-burning equipment	$ 6,000
Heating plant (not allowing for enclosed radiators)	45,500
Enclosed radiators (extra heating surface, linings, grilles, etc.)	5,500
Total cost of heating installation	$57,000
Temporary radiator connections	2,000
Total heating contract	$59,000
Cabinet work for radiator enclosures	4,000
Total cost to owner	$63,000

The panel job for the same building figures out as follows:

Oil-burning equipment	$ 6,000
Cost of panel heating system	61,000
Cost of entire heating installation	$67,000
Additional cost of special plastering for heating panels	4,000
Total cost to owner	$71,000

As will be seen from the above tables (and on the basis of costs prevalent in Washington and vicinity), the panel heating installation for such a building would cost today about 12½% more than such a high-grade steam plant as might ordinarily be used in a building of this nature.

The above comparison assumes that, if the building were heated with steam, space could be found for, and architectural requirements satisfied by, the use of enclosed radiators in all the principal rooms. As a matter of fact, the finer and larger residences usually require the heating of many of the principal rooms by gravity-indirect stacks located in the cellar, with duct connections to registers in the rooms. It is not uncommon to see this method of heating employed in such a residence for practically all the ground-floor rooms (other than the kitchen and service quarters) and even for a number of the principal second-floor rooms. Obviously, *such* a steam heating system costs considerably more than one using only radiators.

Studies of such cases lead to the conclusion that a panel heating installation would actually cost less than this sort of steam heating plant.

Designers and Contractors

The British Embassy was designed by Sir Edwin Lutyens, R. A. Associated with him as supervising architect was Frederick H. Brooke, of Washington, D. C. The heating design was originated by Richard Crittall & Co., Ltd., of London, while the actual plans and specifications were drawn by Jaros & Baum, consulting engineers of New York, to conform with American weather conditions, materials and structural methods. The plans as finally issued represent the collaboration and joint ideas of both firms.

The Wardman Construction Company, of Washington, D. C., was the builder and general contractor for the Embassy. The heating plant was installed by Wolff & Munier, Inc., of New York (under American license from Richard Crittall & Co., Ltd.).

Materials

The principal equipment and materials used in the heating installation were as follows:

Boilers.....Heggie-Simplex Boiler Co.
Oil-burning equipt..Winslow Kleen-Heet Corp.
Heating system heaters..Patterson-Kelley Co.
Circulating pumps.....Gould Pumps, Inc.
Vacuum-heating pumps..Nash Engineering Co.
Thermostatic control of heaters.....Fulton Sylphon Co.
Non-conducting covering .....Keasbey & Mattison Co.
Sheet-metal fabrication...J. D. Thompson Co.
Underground conduit.....Ric-wiL Company
Panel heating coils....Whitlock Coil Pipe Co.
Coil control valves.Richard Crittall & Co., Ltd.
Cast-iron radiators....American Radiator Co.
Hand and check-valves.....Jenkins Bros.
Boiler water feeders.....McAlear Mfg. Co.
Heavy-duty traps (on heaters).....Warren Webster Co.
Radiator valves and traps (Chancery).....Warren Webster Co.
Pipe.....National Tube Co.

Effects of Too Dry Air

by **M. C. BARNUM**

HAVING explained the varying capacity of air to hold water vapor as its temperature changes, and having shown why indoor heated air in the winter time has such a low relative humidity,* the effects of this too dry air can now be considered.

While many noted figures in the fields of science, literature or the arts have been men not blessed with rugged bodies and strong constitutions, it surely must be admitted that the average person does his best when his health is good. Sickness exacts a heavy toll in actual dollars and cents each year from all of us, whether it be directly by our own illness or indirectly by the illness of some one upon whom we are dependent in one way or another.

Anything that can be done to lessen illness, or to put it positively, to better health, should be of real interest and concern to all. It is the effect on our health of the air we breathe that we will discuss.

While most engineers can name off-hand the chemical composition of air, there may be some who will want to be reminded that approximately 21%, by volume, is oxygen, the most important element in its composition, and 78% is nitrogen. Carbon dioxide, argon, ozone, xenon and several other rare gases in minute quantities make up the other 1%. Water vapor is always present in the air in varying quantities as atmospheric humidity and is next to oxygen in importance in supporting life.

Water vapor being a gas diffuses rapidly and evenly. It does not depend upon circulation for its distribution. Many people are surprised to hear that humidified air is lighter than dry air. This is perhaps best explained by saying that water vapor is not added to dry air, as you would add water in liquid form to some object like a sponge, but the water vapor, which is a gas the same as dry air, displaces a certain volume of dry air, resulting in a mixture of humidified air that is lighter than the dry air formerly occupying the same space.

The following table gives the weights of saturated air at 70° F.

		Lbs.	Grains
(1)	Weight of 1 cu. ft. of dry air	.07495	524.65
(2)	Weight of water vapor in 1 cu. ft. of saturated air	.00115	8.05
(3)	Weight of actual amount of dry air in 1 cu. ft. of saturated air	.07315	512.05
	Weight of the saturated air (total of 1 and 2)	.07430	520.10

In breathing, oxygen is drawn into the lungs and carbon dioxide is given off. On this account it was long thought that an excess of carbon dioxide was built up which caused asphyxiation in poorly ventilated rooms. It has been proved that the carbon dioxide content in even the most crowded rooms is harmless. It is believed that the temperature and humidity are the determining factors rather than the chemical composition, except in certain manufacturing processes where dangerous gases or dusts are given off, such as carbon monoxide from gas engines, etc.

The indoor temperature must be kept at what exhaustive tests have proven to be the proper degree for the existing conditions, and the humidity watched with equal care, both to see that the moisture content is neither too low nor too high. If the air is too hot radiation and conduction of heat from the body is prevented. If it is too moist evaporation of the body moisture is retarded or stopped entirely. The combination of high temperature and high humidity causes a feeling of discomfort.

*Humidity for the Home, HEATING AND VENTILATING for May, 1930.

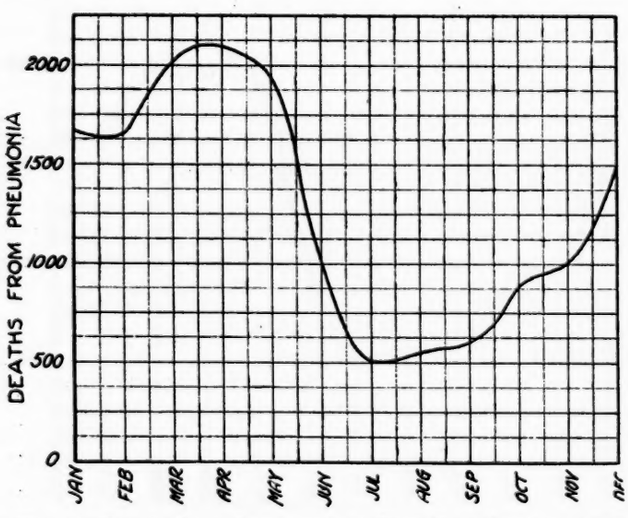


Fig. 1. Deaths from Pneumonia in New York State in 1928

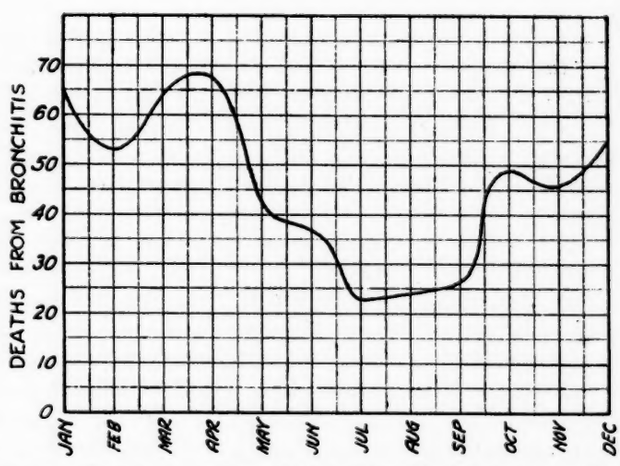


Fig. 2. Deaths from Bronchitis in New York State in 1928

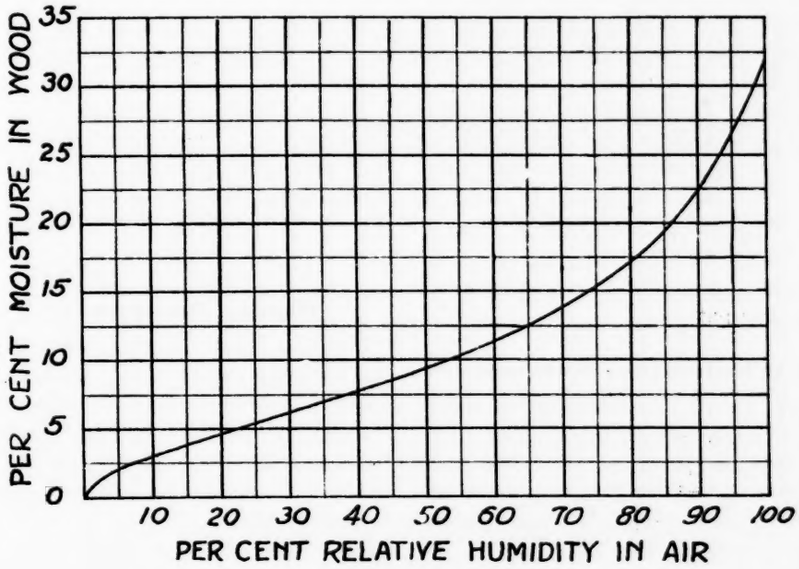


Fig. 3. Per Cent of Moisture in Wood at Different Relative Humidities

Dr. Herman N. Bundesen, for many years Commissioner of Health in the City of Chicago, is perhaps one of the best known of our Public Health officials who has made a real study of this subject and has written quite at length on it. He says: "Proper moisture, or what is known as humidity, is not merely desirable, but is essential to health and comfort. Humidity and temperature are in close relation and both must always be considered in connection with ventilation."

Respiratory diseases are the most common of our human ailments affected by temperature and humidity. Contrary to the belief of most people, "the breathing of cold air affects the mucous membranes of the nose in such a way as to encourage the invasion of disease germs," according to Dr. J. A. Meyers, Ph.D., M.D., professor of preventive medicine and chief of chest clinic of the University of Minnesota, Minneapolis. To continue quoting Doctor Meyers: "In the treatment of the acute respiratory diseases such as coryza and bronchitis, cold air has an unfavorable effect. How often we see a patient who complains of frequent prolonged colds terminating in bronchitis which may become subacute. The ordinary methods of treatment have proved of no avail but, upon inquiry, we find that he is sleeping out of doors or in an extremely cold room, and will continue to have these colds until he can be convinced that he should breathe reasonably warm air with the proper humidity. With our new knowledge of the effects of the air upon the body, we are fast passing the day when pneumonia is treated in a very cold room. Better results are obtained when the air in the room is kept in the neighborhood of 68° with a humidity of 40% to 50% than when the windows and doors are thrown wide open and the patient is subjected to great exposure."

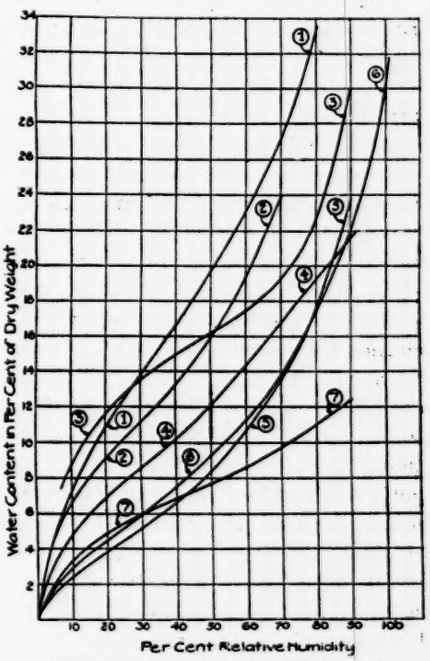
Doctor Meyers holds to the same theory regarding the treatment of tuberculosis, namely that the patient is better off at a temperature of 68° F. and a relative humidity of about 40% than in the extreme cold. He speaks of the "tremendous amount of energy required on the part of the body to keep warm" and believes that this is an unnecessary tax upon the patient.

By referring to the chart shown as Fig. 1, the marked increase in deaths in New York State for the year 1928 due to pneumonia during the heating season can be seen. The fact that the number was but 500 in July as against 2000 in March indicates the lowered vitality of the patients at the end of the winter and the effect of the dry indoor air as against weather conditions in the summer. Fig. 2 shows a similar chart for deaths in New York State in the same year from bronchitis. The two are very similar as to the prevalence of these two respiratory diseases during the winter as against the summer months.

Other illnesses and complaints aggravated by too dry air are influenza, catarrh, eczema, dryness of the skin and the tendency to chap, itching and burning of the eyes, nervousness, irritability, sleeplessness and rapid pulse.

The effect of too dry air on wood is well known. Visible evidence of this is seen daily during the heating season in the drying out and destruction of our furniture. Water occurs in green lumber in two distinct forms—as "free" water in the cells of the wood and as "imbibed" water in the cell walls or fibres. The free water can leave the wood without any apparent change except in the weight of the wood, but when the imbibed water begins to leave, actual shrinkage in size begins to take place. This is what happens when the woodwork in our furniture, millwork, trim, and floors is subjected to the extremely dry air in our modern heated buildings.

Fig. 3 shows the per cent of moisture in the wood at different relative humidities of the air. From 6% to 8% moisture content is usually found in such lumber as above referred to.



(Reproduced by permission from "International Critical Tables")

Curve No.	Material
1	North Carolina leaf tobacco
2	Cigarette tobacco (Fatima)
3	Sole leather (oak tanned)
4	Catgut
5	Soap (Ivory)
6	Lumber
7	Glue (hide, first grade)

Fig. 4. Hygroscopic Moisture of Some Organic Substances

If this lumber is subjected to a relative humidity of 20% or less, which it frequently is in the winter time, the moisture content drops to below 5%. Inasmuch as the shrinkage is nearly proportional to the amount of drying of the imbibed water it can be seen why the furniture comes apart, the floors open up and creak, and the panels in the doors shrink so noticeably.

This shrinkage in lumber is not uniform in all directions. There is practically no longitudinal shrinkage —that is lengthwise of the log or tree. In boards that are cut tangentially there is apt to be about 50% more shrinkage than in boards cut radially. Shrinkage in various lumber will be found to be more or less proportional to the density or weight of the board. That is, the heavier boards will shrink more than the lighter ones.

Fig. 4 shows a chart somewhat similar to Fig. 3. It gives the per cent of moisture in a wide variety of materials, including lumber, for various humidities. This chart will be found useful in figuring the loss in weight in material bought and sold on a pound basis.

One manufacturer of domestic rugs urges the maintenance of proper humidity to improve the appearance and prolong the life of rugs. In dry air the bristles or nap of a rug become brittle and break off easily, whereas if the air is properly humidified the rugs stay soft and flexible and will bend as they are walked on rather than break. The same applies to all fabrics, drapes, upholstery, bedding and even the clothes we wear.

In the printing industry static electricity causes the paper to cling to the cylinder and fly rods when on the press, or two sheets stick together in feeding. The static is more pronounced as the humidity is decreased. Curling and shrinkage are also caused by too dry air with consequent improper register. In the bindery a lack of proper humidity directly affects the folding of the paper. It is almost impossible to fold paper evenly and smoothly in dry air.

A need of humidity seldom appreciated by the layman is in hospital operating rooms. In the hospital operating room static electricity has been found to constitute a real danger, due to the possibility of its igniting the anesthetic being used. This is such a hazard that the National Board of Fire Underwriters recommends the humidifying of all operating rooms where ether, ethylene or ethyl chloride are used. It recommends maintaining a relative humidity of 60% as it has been found that at 54%, static charges are dissipated.

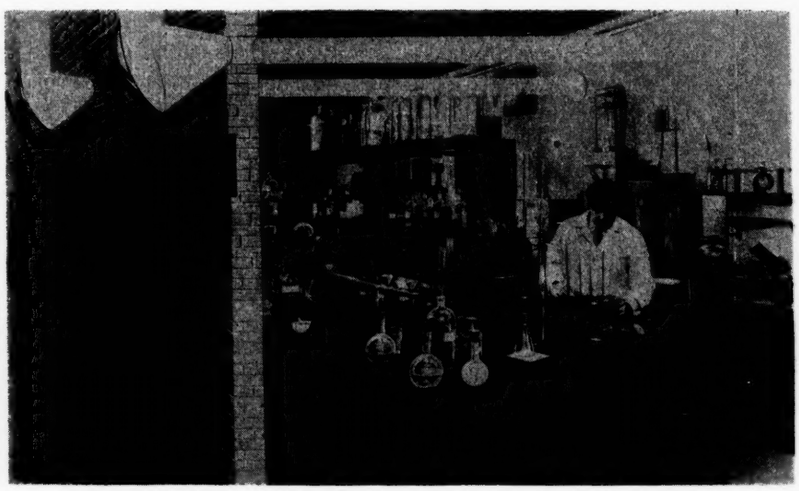
A Windowless Laboratory

Dr. Frank E. Hartman, a recognized authority on ultra violet light, is making plans for a windowless laboratory where he hopes to study the physical properties and physiological effects of air.

The laboratory building will be made as air tight as possible and the air supply introduced and controlled mechanically. Illumination will be accomplished through small bull's-eyes located along the outer wall and near the ceiling of the room, thereby replacing the usual windows. Condensers will be provided and directed so as to receive the maximum sky shine and luminosity, and will receive and reflect the light from the sky through the transmission lenses to diffusing reflectors within the room, which may be so focused as to illuminate with uniform brilliancy. Further condensers and reflectors may be installed within the room when difficulty is experienced with corners, so that every part of the room may be flooded with the sun's full spectrum.

Any degree of recirculation will be permitted through the design of the ventilating system. Ozone equipment to deodorize the air during the day, and various forms of apparatus for producing atmospheric ions, will be installed.

Doctor Hartman proposes to study the effect of superheating, and the influence of high temperature on intermolecular forces of the gas molecules of air, based on the theory of radiating molecules.



Dr. Frank E. Hartman, a Recognized Authority on Ultra Violet Light, in the Laboratory Where He Is Studying the Properties and Physiological Effects of Air Under Ideal Conditions of Ventilation

Piping Handbook

"Piping Handbook" carries ample recommendation in the fact that the authors are J. H. Walker, superintendent of central heating, of the Detroit Edison Company, and Sabin Crocker, engineer with the Detroit Edison Company.

The handbook provides an authoritative and acceptable volume of data for the engineer in piping work. The subjects covered include definitions, properties of fluids, metallurgy of piping materials, pipe, valves and fittings, heat insulation, hangers and supports, expansion and flexibility, steam power plant piping, building heating systems, plumbing systems, underground steam piping, water-supply piping, fire-protection piping, oil piping and gas piping.

Of particular interest are the chapters on expansion and flexibility, in which simple methods are given for computing the expansion stresses and anchor thrusts in piping lines, the chapter on steam power plant piping, and that on oil piping.

Size, 5 in. x 7¼ in. pp. 763. Published by McGraw-Hill Book Company, or may be secured from the Book Department, HEATING AND VENTILATING, 521 Fifth Ave., New York. Price $5.

Design of Combustion Chambers for Oil-Fired Boilers

III – High-Pressure Boilers (Concluded)

by KALMAN STEINER and PAUL R. UNGER

Firebox Boilers

FOR a high-pressure firebox boiler the design of the combustion chamber is very similar to that discussed in the April issue under the heading "Low-Pressure Firebox Boilers," with this exception. High-pressure boilers usually are called on to develop more than 100% ratings.

The case here illustrated is a 150-H.P. Erie City Economic boiler (Fig. 2), designed to carry 150% of rating. Lacking headroom, a pit was constructed and the boiler was set up with a 54-in. base. Further to increase combustion space, the bridge wall was moved back under the shell. This gave ample combustion space to develop efficiently 150 H.P.

This boiler also may be effectively fired from the rear, using the same setting as in Fig. 2, with a front bridge wall constructed similar to that in Fig. 4, referring to low-pressure firebox boilers (see HEATING AND VENTILATING for April, 1930).

Marine Boilers

The general construction of a marine boiler makes it readily adaptable to oil-firing. Its long, narrow firebox, entirely surrounded by water, makes possible the transmission of a considerably greater portion of heat by radiation than in any other type of boiler. The burner nozzle should be located just below the center line of the internal furnace. When the boiler is heavily overloaded the bridge wall is omitted entirely, as shown in Fig. 3, giving the entire length over to combustion space. However, a checkered target wall at the end of the furnace is employed to retard the gases as they enter the flues. The same principles of air admission apply as previously outlined; the amount of refractory surface, however, of necessity is less in a marine boiler than in another type.

Marine boilers are of two types: wet back and dry back. Fig. 3 illustrates a dry back. Note that a heavy firebrick insulation is needed to protect this part of the shell, which lies directly in the path of flame travel. In the case of the water back, only the cleanout door needs insulation.

With the setting as shown, an overload of from 20% to 40% can successfully be carried. If still greater overload is desired, it is usually necessary to resort to a Dutch oven, instead of the flush front shown. The oven should be so sized that combustion will be almost complete before the gases enter the boiler. Brickwork in the boiler proper is omitted, providing more heating surface for actual contact with the gases. High efficiencies should result from this kind of setting. The cost of maintenance on the oven will be high because of the intense heat of the fire and the lack of heating surface.

Vertical Tubular Boilers

Where space limitations prohibit horizontal boilers, vertical tubular boilers sometimes are used. To make a successful installation of a horizontal rotary oil burner in a vertical boiler, a special setting is required. Fig. 4 shows a 30-H.P. vertical boiler. The entire boiler is set up on a 48-in. base. An oven is built extending 2 ft. in front of the boiler, giving a total horizontal flame travel of 5 ft. and a combustion volume of 35 cu. ft. Combustion is complete before the gases enter the tubes. The specific installation here described carried efficiently a 50-H.P. load on a 30-H.P. boiler. This would be impossible to attain by using the standard setting and firing through the ashpit or fire door.

Water-Tube Boilers—Cross-Drum

Water-tube boiler furnaces, in general, present two distinct problems, in so far as combustion and flame application are concerned: the combustion chamber proper and the baffles arranged in the tube system. The theories involved in the combustion-chamber design are similar to those for any other boiler, while the methods of placing baffles are peculiar to water-tube boilers. As a rule, the natural tendency for the hot-gas travel in fire-tube boilers is exactly that suited to the boiler heating surfaces, while in the water-tube, the natural line of flow would cause serious short-circuiting of the gases over only a part of the total tube surface.

Fig. 5 gives a typical layout for oil-firing a cross-drum water-tube boiler, employing a Dutch-oven front. This boiler setting is intended for installation where low head-room requires a correspondingly low setting. It will be noted that the lower drum is just a few inches above the floor line and, as a result, the firebox had to be extended in front to secure ample combustion volume.

The resultant high floor temperature of the setting necessitated unusual insulation under the firebox, consisting of, first, 4½ in. of hollow tile above the concrete, then 4½ in. of Sil-O-Cel block, and finally 4½ in. of fire brick. In addition, the air tunnel above the firebox gives added protection, through the cooling effects of air constantly passing through the tunnel.

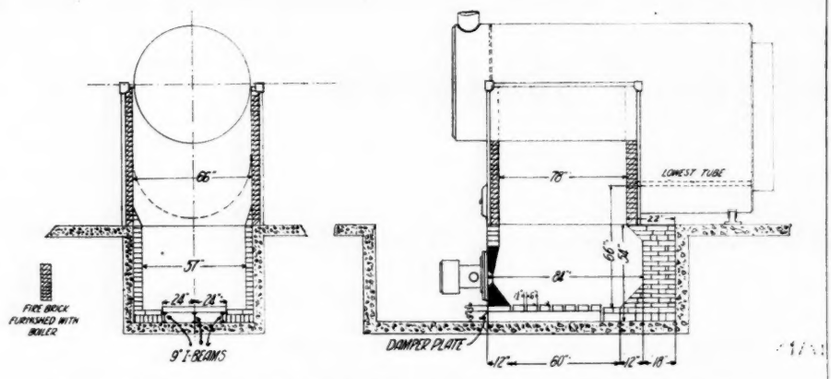


Fig. 2. Arrangement of Combustion Chamber for 150 H.P. Two-Pass Firebox Boiler

Baffling consists of three series of fire tile arranged to force the hot gases through a path that will include the entire surface of the tubes before exit through the smoke outlet.

An important consideration in furnace construction of a water-tube boiler, or any boiler using brick settings, without steel casings, is the matter of air leakage. While the entire subject of structural qualities of boiler settings lies beyond the scope of this paper, it should be mentioned that efficient combustion is predicated on an air-tight furnace. The water-tube boiler, with its extensive brick walls, offers more opportunity for air infiltration probably than any other type. Here the skill of the brick mason must carry on the good work started by the designing engineer.

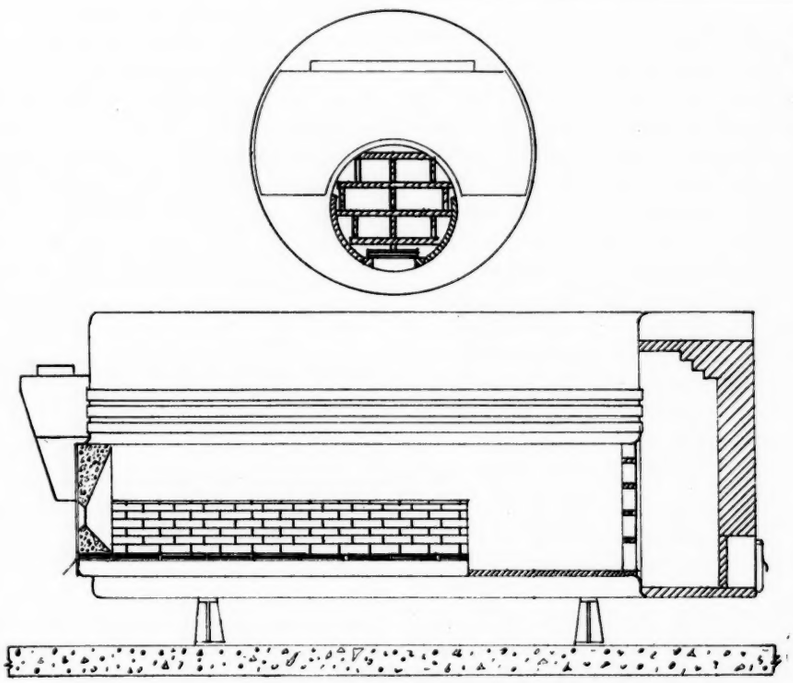


Fig. 3. Combustion Chamber for Oil-Fired Scotch Marine Boiler

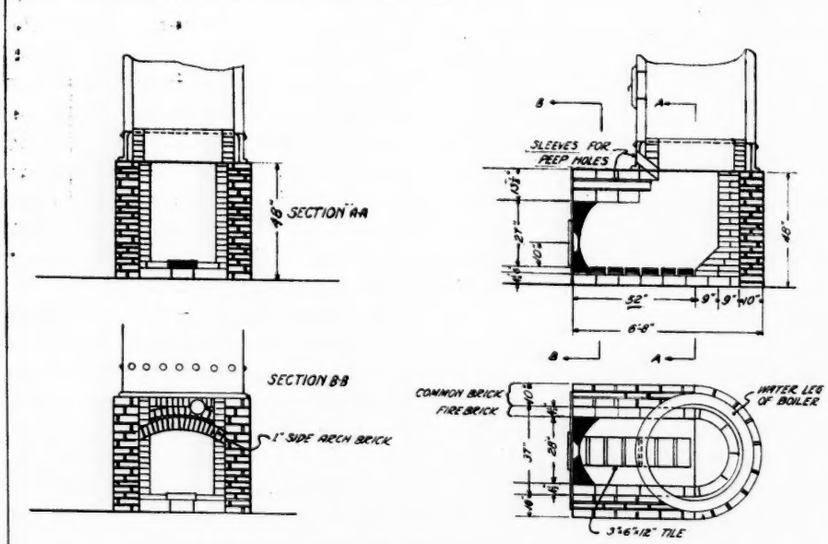


Fig. 4. Details of Dutch Oven Construction in Vertical Tubular Boiler

While Fig. 5 shows the cross-drum boiler in a Dutch-oven setting, the more typical setting would be flush front, with the entire system of drums and tubes raised. This permits of having ample combustion space under the boiler proper. The baffling, however, would not appreciably change.

Water-Tube Boilers—Longitudinal

Fig. 6 is illustrative of an oil-fired furnace under a longitudinal-drum water-tube boiler. The furnace is not greatly different from that of the cross-drum; it is merely adapted to the differing overall dimensions. Baffling is the principal variation, as the inclination of the tubes to the fire differs considerably in the two types.

Present-day practice of operating water-tube boilers at high overloads, 150% to 400%, results in high furnace temperatures. Brickwork must necessarily be more massive to withstand this severe usage. At the same time, free and uniform circulation of the hot gases must be assured, for the localizing of heat application at any one point might easily result in the burning and consequent bursting of a tube.

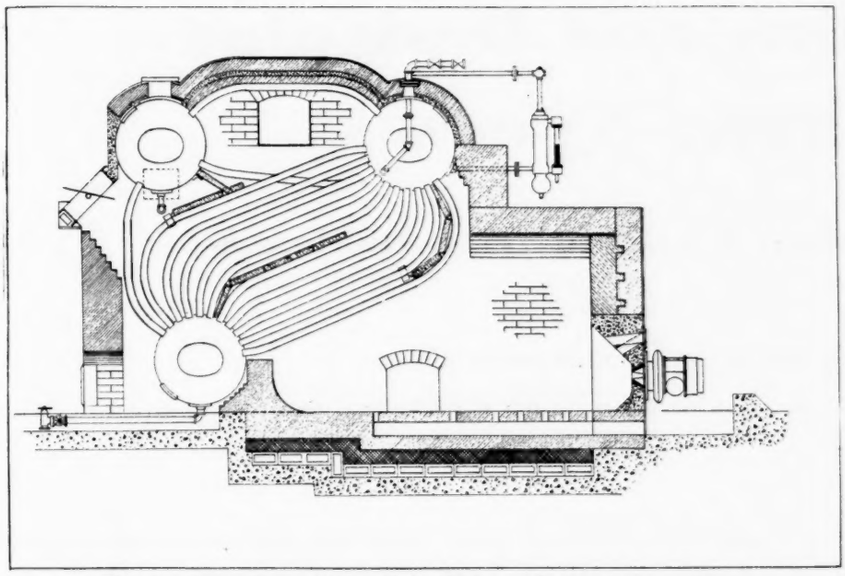


Fig. 5. Cross Drum Water-Tube Boiler with Dutch Oven Front

Consideration of refractories in detail as applied to boiler furnace work would require considerably more space than can be devoted to the subject in this article. Firebrick specifications vary greatly in different parts of the country, according to the source of supply. It should be borne in mind that the general classification of 3000° melting-point brick requires interpretation. Firebrick may fail in use not only from purely temperature effects, but from the combined strains of temperature, pressure, and slagging.

One or two basic rules on firebox masonry might be outlined. Assuming that the best available firebrick has been obtained, it is excellent practice to bond the brick by dipping in high-temperature cement, rather than to use a mortar of ordinary fire clay. The so-called air-setting cements, when applied between the brick in a very thin layer, readily will cause the individual bricks to fuse into a solid mass, thereby securing great structural strength. When high-sulphur oils are burned, serious slagging may result from the chemical action of the sulphurous gases on firebrick.

A successful method of overcoming this tendency is to paint the entire firebox with high-temperature cement. In using plastic firebrick, it should be remembered that while ordinary firebrick are pressed at a pressure of 1000 lbs. per sq. in., this pressure cannot be obtained in molding plastics. Considerable care, therefore, should be exercised in constructing plastic forms of sufficient thickness to overcome this inherent difference.

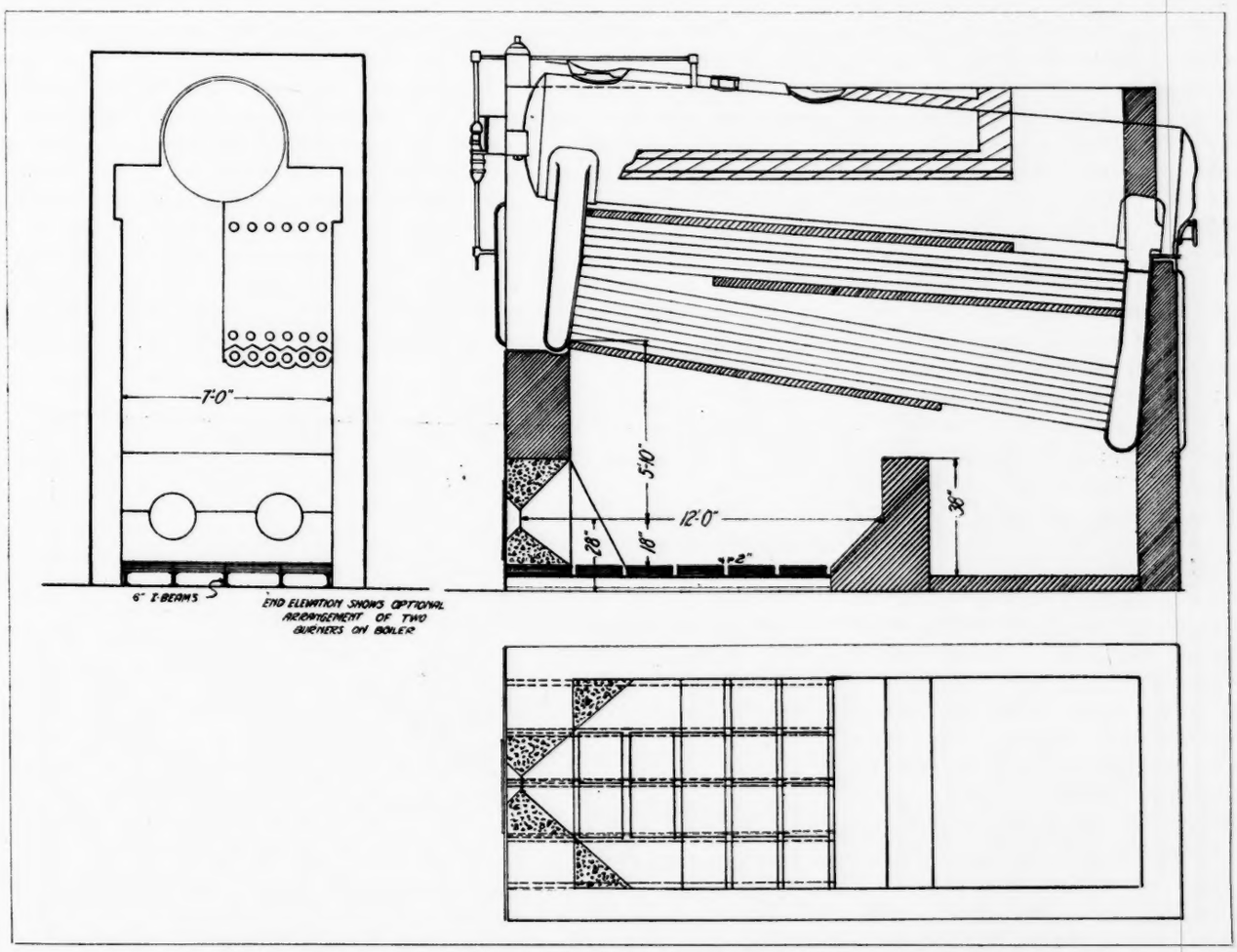


Fig. 6. Bricking Arrangement in a 275 H.P. Longitudinal Drum Water-Tube Boiler

Estimating and Designing Heating Systems

Part VIII—Heat Emission from Radiators

by **FRED W. HANBURGER**

Special Lecturer on Heating and Ventilation, College of the City of New York

AFTER the heat loss from a building has been determined the next step is to ascertain the amount of heating surface necessary to offset the loss. This amount of surface, in times past, has always been termed radiation and the heating member was called a radiator. Both are obviously misnomers, since only 10% to 30% of the total emission from the older type of heaters was radiant heat. In many of the later types the ratio is much less.

There always has been some confusion in the terms used in the different branches of the art of heating. We have a multiplicity of names for supposedly different types of steam systems which are intended to imply a distinction that does not always exist. Again, the same term often has a different meaning to the different individual, so that our heating and ventilating language may be said still to consist of a number of dialects. At the present time there is a strong movement to introduce a more descriptive nomenclature pertaining to "radiation" and the following glossary of suggested terms is given as taken from the 1930 A.S.H.V.E. *Guide*.

1. Conductor or radiator—a heater exposed to view, and which transfers heat by radiation to objects which it can "see" and by conduction to the air currents which pass over it.

2. Recessed conductor—a heater set back into a wall recess but not enclosed in any way. A flat surface wall panel heater is a panel conductor.

3. Convector—a heater which is enclosed in a duct or cabinet and which gives off the heat to an air stream, which passes into the room to be heated.

4. Cabinet convector—a heater placed in an enclosure located within the room which is to be heated.

5. Indirect convector—a heater placed exterior to the room which is to be heated. There are both gravity indirect convectors and blast indirect convectors.

6. Direct-indirect heater, or conductor-convector—a heater arranged so that some of its sections operate as convectors, being partially housed in so as to heat air which enters from outside the room, while other sections and part of the housed sections may operate as conductors.

7. Column conductor—the cast-iron column type of "radiator" not manufactured (to any extent) since 1926.

8. Tube conductor—the cast-iron (tubular) radiator of 1930.

9. Wall conductor—the wall type of cast-iron "radiator" of 1930.

It will be noticed that no term has been suggested for the general phenomena of "radiation." It will be a difficult matter to break down the universal conception of the term "amount of radiation," even though it be a misnomer, and adopt some other that would be more correctly expressive. Such terms as "amount of conductance," "amount of convection," "heat-loss," or "heat supply" do not seem to carry the same depth of meaning that popular usage has given to the old expression "radiation."

Transfer of heat from a radiator or, more properly, a conductor or convector, is governed by the same laws that obtain for the heat transmission through the walls of a building but is subject to greater variations. By comparing the two, we get a clearer idea of the modifying factors. The coefficient of transmission through the walls, (U), is fairly

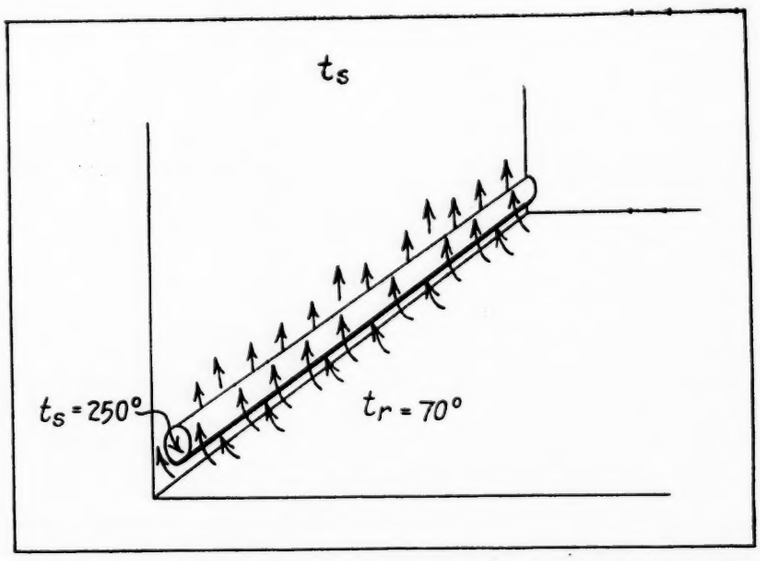


Fig. 25. Conduction of Heat from Steam to Air Sets Up Air Movement

constant at all times and the only factors that change its value are (1) the thickness of the wall; (2) nature of the wall, and (3) the air movement over the surface of the wall. Air movement on the outside of the wall is due to the varying winds and on the inside to the heating element used rather than to the temperature difference between that of the inner wall surface and the room temperature.

This almost unvarying character of the coefficient U does not prevail in that of the heat transfer from radiators. This latter coefficient generally is termed K and its significance is the same as that of U, representing the B.T.U. transmitted through 1 sq. ft. of heating surface per degree difference between the temperature of the heating medium and the average temperature of the air in the room but, as will be seen, the value varies with this temperature difference.

The main factors affecting the value of K are: (a) Difference between the temperature of the heating medium and that of the air of the room. (b) Height of the radiator. (c) Width and length of the radiator. (d) Ratio of the radiated heat to the heat by conduction or convection.

To illustrate (a), the effect of the temperature difference on the value of K, let us take the case of 10 ft. of 1-in. pipe lying horizontally along the lower corner of a room, as shown in Fig. 25, with the steam temperature at 215° and the temperature of the air near the floor at 70°. The value of K for this condition is 2.65. The heat emission may be expressed by the formula

$$H = K\ (t_s - t_r),$$ where

H is the number of B.T.U. emitted per square foot of surface, and t_s and t_r are the respective steam and air temperatures. The value of H in this case is then

$$H = 2.65\ (215° - 70°) = 384.25$$ B.T.U.

It will be noticed that the heated pipe by conducting heat to the immediate surrounding air sets up air currents, as shown by the arrows in Fig. 25, and it can be seen that if the temperature of the steam is increased or the temperature of the surrounding air lowered, it will cause an increased air movement. From our discussion on heat losses we know that an increase in the air movement creates an increase in the heat transfer and, therefore, in this case the value of K becomes greater.

With radiation, then, the temperature difference $(t_s - t_r)$, by changing the air movement, becomes a factor in changing the value of K. This is true in the case of heat losses through walls where the temperature difference between the wall and air has but little influence on the air movement. Some, although a very slight part, of the variation of K no doubt is due to a slight increase or decrease in the radiant heat.

This rate of change may be taken as 0.2 of 1% for each degree of change in the temperature difference above or below what is accepted as standard conditions. The accepted standard conditions are taken as 215° for the heating medium and 70° for the room temperatures, giving a standard difference of

$$(215° - 70°) = 145°$$

Thus in Fig. 25, if we increase the steam temperature to 235° and the room temperature is to be maintained at 60°, the temperature difference is $(235° - 60°) = 175°$, an increase of 30° over the accepted 145° standard. The increase in the value of K then will be $(0.002 \times 30) = 0.06$, or 6%, and the value of K will be $2.65 \times 1.06 = 2.91$ B.T.U.

Heat emission, H, will be 2.91 B.T.U. per deg. difference per sq. ft. $\times$ 175° = 509 B.T.U. per sq. ft. of surface.

The 1930 A.S.H.V.E. *Guide* expresses this relation in terms of heat emission by the formula

$$H_x = H_s\left(\frac{t_s - t_r}{215° - 70°}\right)^{1.3}$$

where H_s is the heat emission under standard conditions, in this case 384.25 B.T.U. The heat emitted, H_x, under the second condition will be

$$H_x = 384.25\left(\frac{235° - 60°}{215° - 70°}\right)^{1.3}$$
$$= 384.25\ (1.207)^{1.3}$$
$$= 384.25 \times 1.276$$
$$= 510 \text{ B.T.U.}$$

Fig. 26. Intercepted Radiant Heat Waves Reduce Heat Emission.

From Allen & Walker's "Heating and Ventilation," McGraw-Hill Book Company.

This change in the value of K due to the temperature difference must be taken into consideration when we use the same radiator for heating with hot water where the temperature of the water is considerably lower than that under standard conditions and will be illustrated later.

Investigating the second factor, (b), the effect of height on the value of K, let us again refer to Fig. 25. With the pipe in a horizontal position the heat emission is 384 B.T.U. per sq. ft., but this will not be the case with the 10 ft. of pipe standing vertically in the room, owing to the fact that the room temperature is increasing toward the ceiling and the temperature difference becomes correspondingly less. The velocity of the air movement in this case probably will be the same so that, strictly speaking, the value of K will not change but the heat emission will be less at the upper end.

Assuming an under-ceiling temperature of 85° and using a K value of 2.65, the heat emission in the upper range will be

$$2.65\ (215° - 85°) = 344$$ B.T.U.

as against 384 B.T.U. near the floor. The average heat emission is

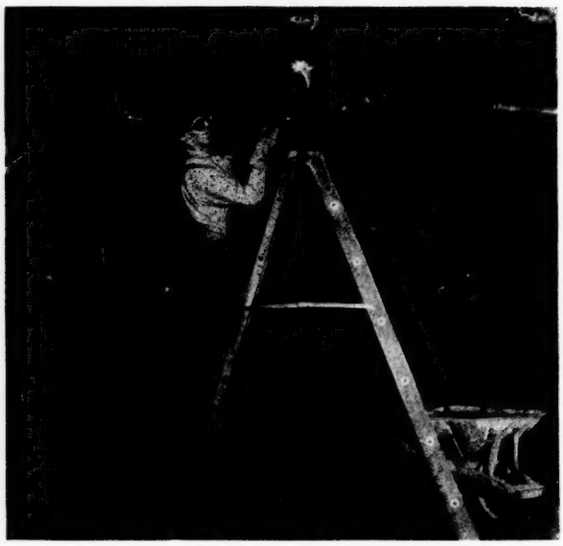
$$\frac{(384 + 344)\text{ B.T.U.}}{2} = 364\text{ B.T.U.}$$

While the value of K has not changed materially it is taken as though such were the case and its value obtained by dividing the average heat emission by the temperature difference. In this case K will be

$$\frac{364}{145} = 2.51$$

Thus the height of the radiator affects the heat emission and the value of K.

In factor (c) the effect of the width of a radiator on the heat emission is due to the high temperature of the air between the columns or tubes with a correspondingly lower temperature difference between the steam and air. This is illustrated in Fig. 26, which shows the horizontal cross-sections of 1-col. and 3-col. radiators. In the wider 3-col. radiator there is a larger proportion of the heating surface exposed to the warmer air. This section also shows a larger proportion of the radiant heat waves being intercepted by equally hot surfaces. This reduces the value of the radiant heat emission from the wider radiator.



Welding the Piping in a Cleveland Hospital

Welded Steam Piping

by **WEBSTER TALLMADGE**

WELDED piping today is nothing unusual. Thousands of miles of oil and gas lines at hundreds of pounds pressure are well known to all of us. Steam piping, however, presents a somewhat greater problem. It carries a hot, expansive, and therefore an explosive, fluid and is subjected to a combination of stresses of

1. Pressure of the fluid.
2. Stress due to resistance to expansion of the piping system.
3. Stress due to weight of the piping system.
4. Internal stress in the metal from fabrication.

Combinations of these stresses in couples in high-pressure steam piping may easily be sufficient to cause rupture.

The problem therefore requires:

1. Rigid welding procedure specifications.
2. Design of proper supports and anchors to preclude abnormal stresses.
3. Suitable arrangement not to only make the connections but provide necessary flexibility in the space available.

The following have been used successfully as specifications of procedure.

Welding Procedure:

It is the intention of the engineer that the closest attention be given to the welding operations to the end that satisfactory joints shall be obtained which shall be of full strength and closeness of structure.

Character and Check of Welders:

Only competent oxyacetylene welders having experience in welding wrought-iron and steel piping shall be employed.

Any welder considered by the engineer as not having the skill necessary for the work shall be at once removed by the contractor.

Welding Inspection:

The contractor shall at all times keep on the premises during the progress of the work a competent foreman, who shall have sufficient experience with oxyacetylene welding to enable him properly to interpret and execute the welding specifications.

The engineer shall have the privilege of having a representative inspect the test of the welders or their work on the line while it is being done.

At the request of the engineer or his representative, as they deem it necessary to insure the satisfactory work or skill of the welders, the contractor shall subject any or all welders to a test or shall remelt a portion of any weld for the purpose of inspecting the quality of the weld metal, or shall remove a small rectangular section of metal across a weld for the purpose of determining the degree of penetration, fusion and density of the welded joint. In event of these tests of the work showing faulty workmanship, the contractor may be required to remove an 18-in. section of the pipe at the weld for further test to be made by him and to replace such section as shall have been removed.

Test of Welders:

Following are the factors that shall be considered in such test and in the work of the welders:

1. A clean welding tip.
2. Soft neutral welding flame, neither pointed nor irregular.
3. Consideration of penetration.
4. "Floating out" of oxides.
5. Even fusion into the base metal.
6. Regular movement of the torch.
7. Occasional check of the neutral flame by throttling back to neutral a momentary excess of acetylene.
8. Uniform incorporation of filler material with the molten puddle.
9. Maintenance of clean, bright red molten metal in the weld puddle.
10. Physical characteristics of weld when pulled in testing machine.

Physical Test of Welding Coupon:

Coupons taken from the material welded in the test or from the completed work shall be pulled and the coupons shall closely conform to the dimensions of the American Welding Society specifications for standard tensile coupons for plate steel. Any reinforcement of weld metal on the outside of the joint shall be machined or ground off so that the thickness of the coupons at the weld shall not

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Abstracted from a paper read before the International Acetylene Association at Chicago, Ill.

exceed the thickness of the base metal. The coupons shall either break outside of the weld or have a minimum tensile strength of not less than 50,000 lbs. per sq. in. for any one coupon and an average of 52,000 lbs. per sq. in. for all specimens.

Welding Material:

Oxweld No. 1 high test welding rod must be used for oxyacetylene welding. Operators must demonstrate their ability to use this rod before progressing with the work.

Welding Apparatus:

Welding and cutting blowpipes and regulators manufactured by any reputable concern may be used. They shall at all times be kept clean and in proper condition. Only oxygen and acetylene gases shall be used.

Preparation of Material for Welding:

Butts to be welded shall be scarfed or bevelled according to Fig. 1. Exception will be permitted for making up tie-in joints in which case bevelling may be done with the torch provided the finished bevel conforms closely to the specifications and that all scale and oxide shall be removed from the bevelled edges by means of a hammer, chisel, or file.

Butt welds shall be a width of not less than 2½ times the pipe wall thickness, a penetration to the inside wall of the pipe or to the bottom of the V, and a reinforcement on the finished side of not less than 25% of the pipe wall thickness. There shall be no valley at the edges of the joint and the weld shall be built up so that the weld metal shall present a gradual increase in thickness from the surface of the pipe to the center of the weld.

Pipe surface to be welded shall be free from all scale, oxide, or other foreign material. Joints shall be carefully aligned, spaced and tacked (temporary weld for alignment) at a sufficient number of places to secure and maintain their alignment. Clamps may be used to facilitate the lining up and tacking of the pipe sections. No pipe shall be erected in such a manner as to prevent the easy manipulation of a welding torch or rod while making the tie-in or position welds.

Proper allowance for contraction due to welding shall be made in setting up pipe that must make up exact dimensions. Pipe other than bends shall not be sprung into position. Where undue strain is required to join the piping, the pipe on either side of such joint shall be properly adjusted by the aid of heat under proper supervision or, at the discretion of the engineer, or his representative, be reconstructed.

Welding Technique:

These specifications do not attempt to restrict the welders to any one method of manual production of weld metal, the gas pressure used during welding, or the manner in which they apply themselves.

So-called ripple welding is not essential. A flat finished reinforcement is equally as good. Care must be exercised fully to fuse the base metal with the deposited metal. A penetration of the weld metal to the inside wall of the pipe is essential for all joints. Care must, however, be exercised to prevent the occurrence of protruded weld metal into the pipe which restricts flow. The weld shall be of sound metal, free from laps, cold shuts gas pockets, oxide inclusions and similar defects. The backhand method of welding and continuity of deposition are recommended for butt welds. This, of course, applies to rotative welds mainly but should be observed for position welds where practical.

Where rotation is possible, a continuous weld shall be made as the pipe is turned. On horizontal piping, if position welds are required, the welder must start at the bottom of the pipe and after completing one-half of the joint start from the original point and continue up the opposite side until the seam is completed. All tack welds shall be melted out as the welding progresses, and incorporated in the joint.

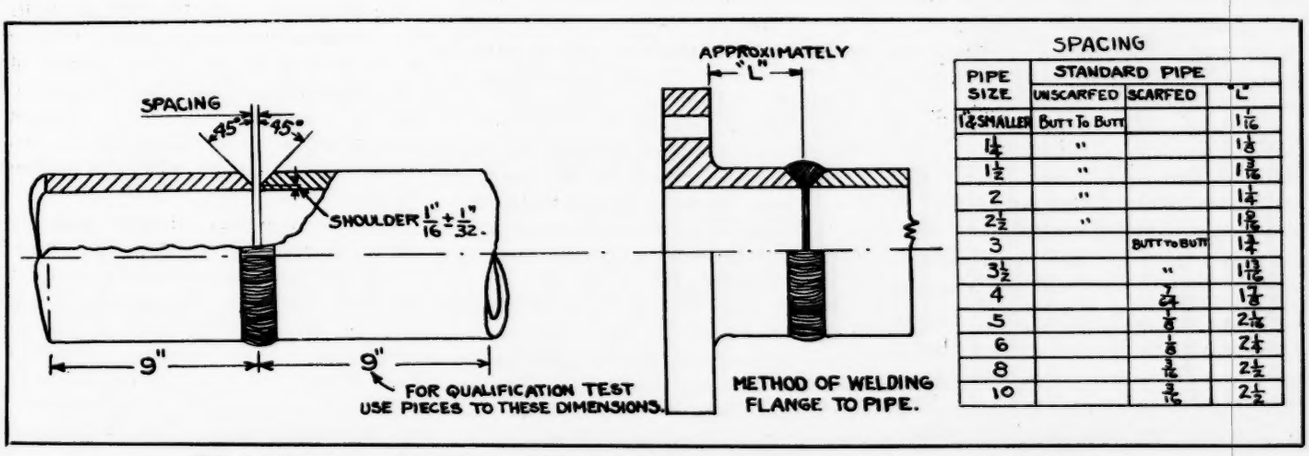
If the welding has to be stopped for any reason, the operator on restarting shall reheat the weld for an overlapping distance of two inches and shall remelt and reweld into the previously welded portion for a distance of about a half-inch or until solid weld metal is exposed. Where the weld ties into a previously welded portion, the operator shall observe the same requirements as given above for restarting incompleted welds.

At the point where the weld begins and ends particular care must be exercised to insure against a porous crater to permit leakage.

All pipes 1½-in. and less are to be bent by first heating with torch. With pipes 2-in and larger when torch bending is impossible a Tube-Turn must be welded in.

Welded steam piping may be divided into three classes:

1. High-Pressure Plant.
2. High-Pressure Underground.
3. Low-Pressure Heating.



SPACING

PIPE SIZE	STANDARD PIPE		
	UNSCARFED	SCARFED	"L"
1¼ SMALLER	BUTT TO BUTT		1 1/16
1¼	"		1 1/8
1½	"		1 3/16
2	"		1¼
2½	"		1 5/16
3		BUTT TO BUTT	1¼
3½		"	1 13/16
4		7/64	1⅜
5		⅛	2 1/16
6		⅛	2¼
8		3/16	2½
10		3/16	2½

Fig. 1. Spacing and Scarfing of Gas Welded Pipe for Pressures under 30 Lbs. per Sq. In.

High-pressure power plant piping has been gas welded for twenty years and when properly done under good welding procedure specifications, it is beyond comparison for low amortization, low maintenance and low first cost. The marked absence of leaks from reduced number of packed joints lengthens the life. A leak erodes away the metal of the joint flange face or thread, making it impossible to be kept tight.

Some welded joints have failed from poor workmanship, by unskilled men or from internal fabrication stress plus external strain or in some cases due to the parts not having been annealed. It is sometimes necessary to anneal welds on massive work on pipe 6-in. and larger subjected to unusual pressure or unusual external strain by means of a portable furnace around the weld. In emergency cases we have set up improvised furnaces in the form of a loose dry firebrick box around the pipe heated with either a coke, oil or gas to a cherry red and reducing the heat slowly. The most important point in the writer's opinion is to avoid rigidity in laying out the design by avoiding anchors and by use of long flexible hangers such as chain, free to move in all directions and with springs compressed initially to three times the pipe movement wherever vertical expansion is encountered. These are called "floating piping systems." A usual movement in any portion distributes the strain through the piping system instead of concentrating it.

Every possible joint and gasket should be avoided. The Sargol joint is universally used in all modern high-pressure piping. It is a flanged joint of the Van Stone type in which the flanges are loose forged steel rings drilled for the bolts. They are placed loosely on the pipe, the ends of the pipe are then heated and a short radial lip is rolled or pressed on each end. The faces of the lips are then machined true and the periphery chamfered or bevelled to form an apex to be fused or a crater groove to be filled with a welding torch as a seal, instead of a gasket. The crater type is preferred by many as it can be easily separated by a chipping hammer and reused. This is, however, optional as it is seldom necessary.

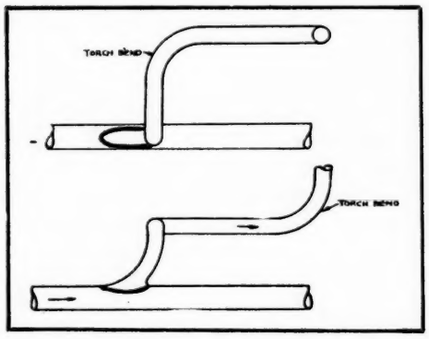


Fig. 2. Streamline Welded Piping Details

Reduced piping resistance can be brought about by a method of torch bending the pipe into shape on the job as the heating piping system is fabricated. Joining the "run out" pipe supplying a radiator to its riser by welding an easy lateral branch and torch bending the pipes in gradual curves, Fig. 2, the resistance to the flow is little more than the resistance of the corresponding straight pipe before bending.

Largest Coal Breaker Placed in Operation

The largest coal breaker in the world, constructed by the Philadelphia and Reading Coal and Iron Company at Locust Summit, a few miles west of Ashland, Pa., with machinery on seven floors, was placed in operation during the first week in March.

The new breaker is four times the size of any present breaker in the anthracite region. Its interior is radically different, and entirely new methods are used from those employed in other plants.

In old breakers the coal was moved about by means of scraper lines, which consisted of iron blades scraping the coal along deep iron troughs. In the new plant, coal will be moved on top of rubber conveyor belts a yard wide. This will prevent breakage of coal in moving. The coal is first run on to the shakers, which size the coal as it is sent into the large sand cones, located on every floor. The specific gravity of the water in these cones has been raised by the injection of fine sand. High paddles in the bottom of the cones keep the water and sand stirred and the coal floats while the rock and slate sink to the bottom.

A new apparatus for the loading of boxcars has been installed. This device lifts a car and tilts it on its side so that coal may be run in directly from the chute at the bottom of the breaker. The new structure has steel stairways and white concrete floors.

National Standards for Pressure and Vacuum Gages Recommended

Establishment of national standards for pressure and vacuum gages was recommended at a general conference held in New York, May 15, under the auspices of the American Standards Association. A technical committee will be made up of official representatives of manufacturers and users of pressure and vacuum gages and of other organizations and specialists having an important interest in this field.

The scope of the committee's work will include nomenclature and definitions; rules and specifications for installation and use; methods of testing; methods of expressing allowable errors; accuracy requirements; capacity ratings; connections; indicator hands and stop pins; dials and graduations; bezel rings and attachments; case sizes and mounting holes.

In general, the conference favored the development of specifications tending to unify the external features of gages of the indicating types, and permit a reasonable amount of interchangeability between the various makes. One group present at the conference pointed out that at present it was necessary for them to carry in stock 72 gages of the same size in order to meet the demands of those to whom they sold their product.

The following manufacturers of gages were represented: Acme Gauge and Instrument Co., Ashton Valve Co., Brown Instrument Co., Consolidated Ashcroft Hancock Co., Crosby Steam Gage and Valve Co., Foxboro Co., James P. Marsh and Co., Motor Meter Gauge and Equipment Corp., C. J. Tagliabue Mfg. Co., and Taylor Instrument Co.

Gas House-Heating Shows Large Increase

Preliminary estimates on the manufactured gas industry for 1929, made by the American Gas Association, indicate an increase of 51.7% in the amount of manufactured gas used for house-heating, as compared with 1928. During 1929, 27 billion cu. ft. were used for this purpose, as compared with 17.8 billion cu. ft. in 1928.

Monthly summary of gas company statistics, released at the same time, shows that house-heating in Connecticut increased 120.1% in the amount of gas used for house-heating for the first 10 months of 1929, as compared with the same period for 1928; for the state of Illinois an increase of 27% is recorded; for Michigan, 57.9%; for Wisconsin, 64.4%.

Rating Buildings According to Quality of Construction

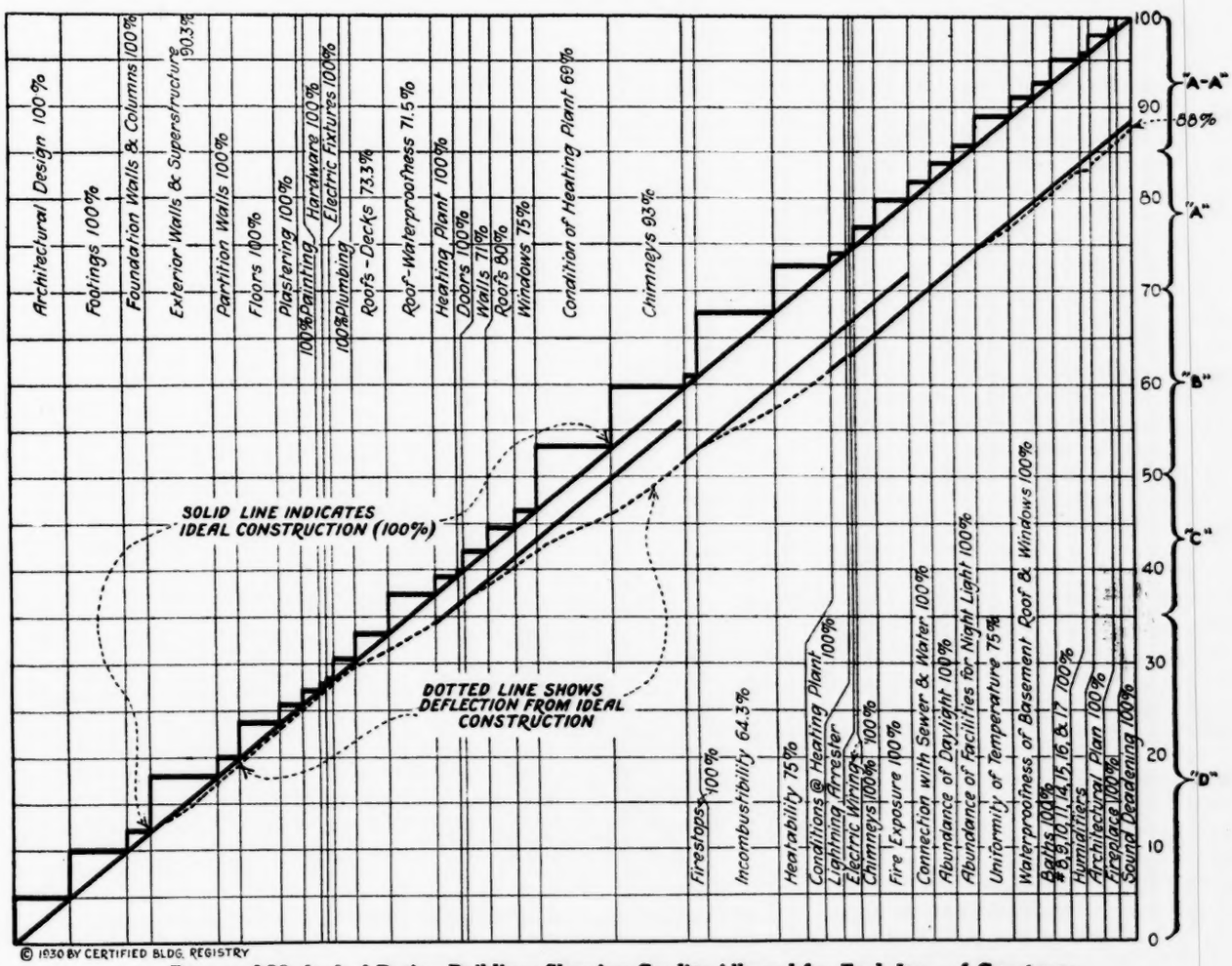
by **CLYDE A. MANN**

A system of rating buildings for their loan and resale value is receiving renewed attention, as the result of the movement now on foot to stimulate building operations during the coming spring and summer. According to the plan, which has been applied to some extent in the Middle West, it is proposed to set up impartial engineering bureaus for the purpose of having them pass upon plans that are to be submitted to leading institutions specializing in building construction finance, to inspect such buildings during the course of construction and to issue certificates covering workmanship and material used.

Every city and town would maintain a bureau to supervise the construction of all dwellings and other buildings where loans are wanted from local lenders or from local persons, firms or institutions representing lenders from other places.

At first these bureaus probably would be financed by the lending interests. Ultimately they would be supported from fees obtained by the bureaus from borrowing builders. It has been suggested that a specially-prepared certificate be given to builders of approved houses. For example, a house of first-class construction and finish would be awarded a Class A certificate, and a house not so good would receive a Class B certificate. The buying public would soon begin to distinguish between a Class A and Class B building and this would act to compel a high quality of construction.

New York City seems destined to be the first to put "rating" to work effectively as one service needed to reduce the evils in speculative building. Representatives of some of the largest lending institutions recently have said they would welcome an authoritative system to discriminate in favor of quality construction. The "rating" plan includes "fuel cost rating" as one index to economical operation. Work already done in Chicago and Detroit has covered "fuel cost" as one of four factors rated, the others being permanence, fire safety and comfort.



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Proposed Method of Rating Buildings Showing Credits Allowed for Each Item of Construction and Score Made by Typical Building

In working out practical means for inspectors to identify chimneys and conditions about heating plants from the fuel-cost rating standpoint, engineers of Armour Institute of Technology in Chicago, men who were in the Fuel Administration service during the World War, produced data put into rating charts, which emphasize the importance of considering the fuel wastes in buildings. As a starting point the *possible* waste of fuel due to poor chimneys is put at 25%. (This does not apply to such fuels as petroleum and gas that are not so dependent for combustion results as coals are on the chimney draft.)

For the flue that is not "leaky" by reason of cracks and poor lining (if any), the better-than-the-worst chimney is found to save 25 lbs. of coal (anthracite basis) per ton of consumption, which in a 20-ton house means each year ¼ ton of coal. In ten years this means $250—which would pay for a lot of mortar to chink up the chimney cracks. But this is only the "tax" for cracks.

Soot in flues, that clogs the draft, costs about twice as much as the cracks.

But when the flue capacity is 50% too small (as so often happens) the tax in a 20-ton house runs in ten years to over $1000, which, of course, would rebuild the chimneys many times.

Rating Conditions of Plants

The faulty conditions of heating plants, it has been found, can account for more fuel, twice as much, as the poor chimney. Right away, a big reduction in this waste is insured by thermostatic damper control. "Rating charts" give heavy credit to thermostatic damper controls—almost as much as is credited to the "certified" installations when a guaranty is given that the radiation or the leader pipes are equal to the capacity of the plants and the plants are equal to the requirements of the houses.

Full and adequate covering of pipes and boiler with air-cell covering is shown to be a trump card for the owner, for, for every ton of coal burned, good covering is credited with a possible saving of 25 lbs., which in a ten-year span means for a 20-ton house, some $500 saved, which would buy covering several times over adequate for the job.

In the case of vacuum valves of No. 1 efficiency the possible "rating" credits are, again, noteworthy—about equal to the possible savings from thermostatic control.

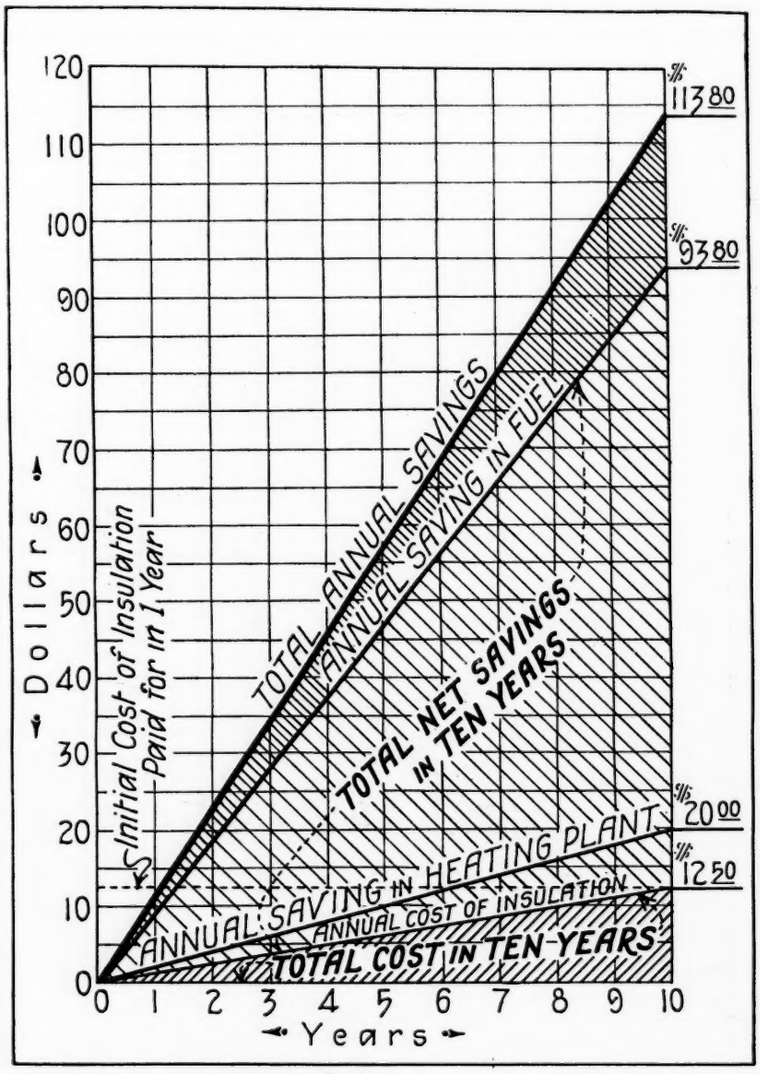
For the "rating" of heat losses at windows and through walls, and through upper ceilings or roofs, charts have been prepared which use approximately the standard of the Heating and Piping Contractors National Association, but make valuable comparisons to types of walls and windows of better construction, and no doubt heat-stopped in some way. By these comparisons, the savings by wood sheathing, for instance, and by weather-stripping, are made in dollars per hundred square feet of wall or per window.

The wisdom of heavy insulation, the use of double or triple thicknesses of the commercial boards or blankets, and the use of mineral wool or similar materials, 3 in. to 4 in. thick, is well illustrated in wall charts for fuel-cost rating of buildings. Whereas the superwasteful type of wall used for definite comparison (just a shell, such as too many speculative builders have served up cold to the home-hungry public) is charged with a heat loss equal to 1256 lbs. of anthracite coal per 100 sq. ft. in this wall plus heatstop about ½ in. thick (of Class "A" efficiency) the heat loss would be reduced about 800 lbs. per 100 sq. ft. When double thick heatstop (of same commercial thickness) is used the saving is equal to over 925 lbs. That 125 lbs. per year difference for ten years pays for the extra layer of heatstop several times over.

Rating Charts for Windows

Comparisons put into graphic form for the purpose of pounding home to bankers the great difference they should recognize in loans between "profit items" such as heatstops, damper equipment, and weather strips and static items of building costs, such as bricks and lumber show amazing returns on investments in many "profit items," including heatstop single, double or quadruple thick.

For example, the cost per 100 sq. ft. for heatstop over a ten-year period is found to have been repaid in fuel savings but also with 600% net profit in the decade on that original cost. But the heavier types of heatstop do even better and argue for adequate heat "insulation." The commercial thickness of 7/16 in. is profitable to use but not adequate to comfort or maximum savings.



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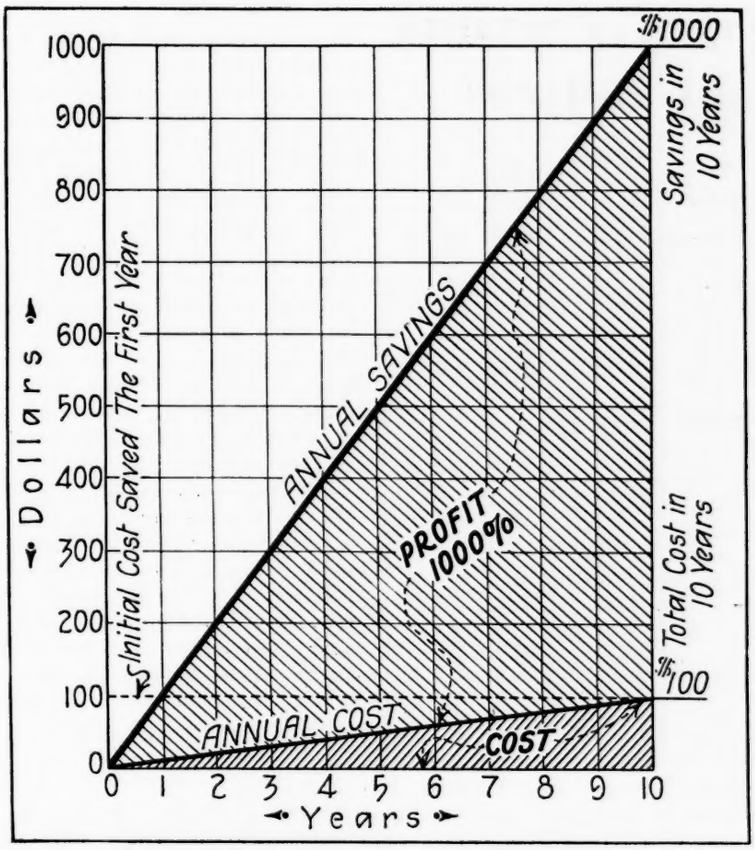
Savings in Fuel and Heating Plant by Using 3½ In. of Poured-in-Place Insulation



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Savings in Fuel Cost by Using Properly Designed Chimneys

For practical use in identifying in exact terms the heat losses of buildings, similar charts have been prepared for various types of windows, ranging all the way from double-hung windows, with wooden sashes so shrunk that they rattle in every breeze, to the tight and weatherstripped windows where infiltration is choked down to a minimum. Here the infiltration reports of the A.S.H.V.E. have been translated into the B.T.U. equivalent in anthracite coal at average market prices. In other words, the Jerry builders' windows, not kiln-dried when installed and sloppily put into place, are shown to cost per year in fuel 1247 lbs. when exposed to the prevailing winter winds in such climates as that of Chicago. With window frames caulked and sash weatherstripped with most efficient weatherstrips, 65% of that fuel cost can be saved. According to the charts, the last-named type of window has a fuel cost "rating" of 65% because of the reduction in heat losses and improvement in efficiency.

Comfort and Heatability

"Rating" the "comfort" factor in dwellings takes cognizance of the "heatability" of a house, both because it bears on solar heat coming in and on furnace heat in winter going out. Rating credits allowed for "uniform temperatures" are in the ratio of the heatability found.

National Engineering Inspection Association Organized

Under the title of the National Engineering Inspection Association, an organization has been formed "to promote a proper understanding and cooperation among those engaged in and concerned with engineering inspection; to establish practices which will prove beneficial to proper service and to develop and encourage better and more effective inspection methods."

The organization is a result of a gathering in December last, in Detroit, Mich., of a group of inspecting engineers and representatives of testing laboratories from all sections of the country. At that time a preliminary organization was formed of those engaged in the practice of testing and supervising the manufacture and use of various engineering materials for construction work of federal, state and city governments; public service corporations; railroad and highway construction and maintenance; bridges; office, manufacturing, educational and other building projects.

At a second meeting, held in Detroit, April 3 and 4, a permanent organization was effected, under the title of National Engineering Inspection Association, with Watson Vredenburgh, president of Hildreth & Company, Inc., New York, as president; J. D. Stoddard, vice-president of The Detroit Testing Laboratory, as vice-president, and B. H. Witherspoon, president of the Pittsburgh Testing Laboratory, as secretary-treasurer.

On the board of directors, in addition to the officers, is a representative from each of the four geographical sections of the country: Henry Gulick, president of Gulick-Henderson Company, New York, for the eastern section; James H. Herron, president of the James H. Herron Company, Cleveland, for the mid-western section; F. B. Porter, president of the Southwestern Laboratories, Fort Worth, Texas, for the southern section; and Abbot A. Hanks, president of Abbot A. Hanks, Inc., San Francisco, Calif., for the western section. The constitution, by-laws and a code of ethics were adopted. In accordance with the by-laws the association will hold semi-annual general meetings.

Twenty individuals, partnerships or corporations, distributed throughout the country, constitute the charter membership of the association. They include seven from the eastern section, seven from the mid-western and southern sections and six from the western section. The usual provisions were made for admitting additional members.

"Building Age" Opens Contest for Contractors on Mail-Order Competition

Following the entrance of large mail-order houses into the home-building business on a national scale, *Building Age* has opened a prize contest to all readers for the best ideas in meeting the new competition. Prizes are $200, $150, $100 and $50, with 5-year subscriptions to *Building Age* offered for ten honorable mentions. Contestants need not be subscribers.

The purpose of the contest is to bring out all possible ideas and suggestions which are available to meet the new mail-order competition. A similar contest with equal prizes is simultaneously offered for building material dealers through *Building Material Marketing*. No limitations are imposed, so that ideas and plans for financing, home-builder service, local advertising or any other phase of activity for combating the mail-order building business are eligible. The contest closes July 10.

Complete details of the contest can be secured from *Building Age* or from HEATING AND VENTILATING, 521 Fifth Ave., New York.

Study of Foaming and Priming in Domestic Steam Boilers

by **HERBERT S. SKACH**

Consulting Engineer, Federated Laboratories, Inc.

As a result of several years of research in connection with the causes of foaming and priming in domestic steam boilers, it can be stated definitely that the problem involves treatment of the water, rather than extensive cleaning out of the boiler. Based upon the same studies, a method of treating boiler water at the time of the installation has been developed, to prevent foaming trouble. This method, developed by the writer, involves the addition of a recently developed chemical compound to the water to be treated in amounts varying with the size of the boiler and the priming characteristics of the water. Further, a priming trouble where it has already developed, can be identified as being caused by a water condition, or it can definitely be found that we must look elsewhere for the cause.

It is possible further by a careful examination of all the available water supply data to determine the correct amount of treatment for water in different localities.

It would be difficult to estimate the labor, expense and trouble that are directly caused by foaming and priming in domestic steam boilers year after year. Without considering the property damage and ill-will, which only too often go hand in hand with priming troubles, if the time and labor losses alone were translated into dollars and cents, the total would be a staggering sum. The burden of this loss is borne by the heating contractor and engineer. In many cases the entire profit on an installation is consumed. Yet it is surprising how little has been done until now toward preventing and curing the conditions encountered.

Boiler and radiator manufacturers have been harassed with a much larger share of the blame than is their due. A foaming condition cannot be caused by boiler design; it is entirely a water condition. In some cases, faulty boiler design can explain *priming* when no foaming exists. There are two facts to be carefully noted, however; first, that the great majority of domestic steam boilers are so designed that they will not prime if the water condition is favorable; second, that no known boiler design will prevent priming if a foaming condition prevails.

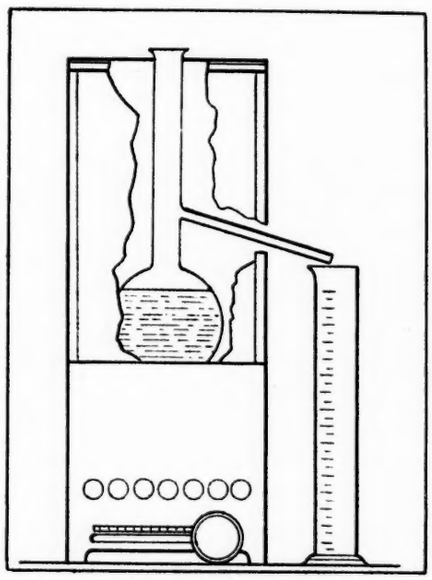


Fig. 1. Skach Foam Meter

We have used the terms "foaming" and "priming." It is well to have a clear understanding of their meanings. By foaming, we mean a condition in which there is formed on and above the surface of the water a layer of stable bubbles of steam and water. The bubbles do not readily break down, and in some cases, the mixture of steam and water is carried from the boiler into the piping and often into the radiators. In this way "foaming" may cause "priming."

By "priming" is meant the presence of water mixed with the steam leaving the boiler steam outlets. A "foaming" condition can prevail without causing priming if the boiler is operating at such a low rate that an insufficient layer of bubbles is formed and does not reach the boiler outlet.

Priming can occur in the absence of a foaming condition if the boiler design is such that water torn from the surface by the rapid flow of steam through the surface is carried into the steam line by the steam moving at too high a velocity, insufficient provision being made for the separation of steam and water. This differs from foaming in that the globules are all water, whereas, in the case of foaming, bubbles of steam and water are formed which are light and therefore much more easily carried over.

Before making a study of the causes and prevention of foaming, it was necessary to have some means of measuring, quantitatively, the priming and foaming characteristics of a water. This need led to the development of the "Foam Meter," which bears the author's name (Fig. 1).

This apparatus furnishes a very simple means for measuring what is termed the "priming coefficient" of a water. The apparatus consists of a small glass boiler, electrically heated, with a constant watt input. All parts are of standard dimensions and specifications, so as to give uniform results if parts should have to be replaced.

A carefully measured 100 c.c. sample of the water to be tested is put into the boiler, which is then enclosed in an insulating case. A graduated receiver is placed at the end of the outlet of the boiler. The current is switched on and at the same moment a stop-watch started. The time is recorded when the first drop comes over and from that time the volume of water in the graduate is recorded every thirty seconds.

In Fig. 2, which shows a number of results obtained with various water samples, it will be noticed that the priming is rapid at first, but that after a time it ceases. This is caused by the increase in steam dome volume and steam disengaging area in the boiler. These increase until the sample of water being tested no longer primes. The line becomes parallel to the line for distilled water.

Since distilled water does not foam, if a run is made on distilled water, the water appearing in the graduate is condensation. The priming coefficient of the water is obtained by subtracting the volume received in the graduate with a distilled water sample from the volume shown by the curve for the sample under test after it has become parallel to Curve 1, both readings being taken at the same time in minutes.

Ability to measure the priming coefficient of a water sample has been of great assistance in the investigation of the causes of foaming. The effects of various methods and quantities of treatment could be studied quantitatively. Furthermore, if a sample of water from a priming boiler gives a priming coefficient of zero, it immediately is evident that we must look to the piping or the boiler for the trouble and not to a water condition; instead of spending a great amount of time and labor in blowing off the boiler, efforts can be directed toward finding flaws in the installation. If, however, we find the priming coefficient to be within the range where foaming trouble has been found,

the trouble lies in a water condition and it can be coped with.

In order intelligently to approach this problem and find a cure for foaming it was necessary first to study its causes. In the literature, the following causes generally are given: 1. High concentration of dissolved solids. 2. Oil. 3. Suspended matter. 4. Organic materials.

High concentration of dissolved solids rarely is found in domestic steam boilers, since all of the water evaporated is condensed and returned to the boiler, the concentration not increasing. The presence of leaks in the system can give rise to this condition and can be detected by the necessity of frequently filling the boiler to the water-line.

Oil present in an untreated water is perhaps the most important cause of foaming, though it is not the oil itself which causes the trouble. By oil we mean here, not mineral oils, but animal or vegetable oils, such as linseed or china-wood oils which are present in pipe compounds, protective coatings on pipe, and sometimes in core sand.

It is not the oils themselves that cause foaming; these oils, in combination with certain chemicals present in boiler-feed waters, or with metals such as iron and lead, form soaps. The foam-producing properties of soap are well known.

Suspended matter present in the boiler water is of minor importance in the case of domestic steam boilers. It has rarely been the cause of foaming when soaps have not been present.

Organic materials found in boiler waters are not serious in the waters with which we are concerned. In other words, if the soaps which have been formed can be destroyed and their formation prevented and at the same time the concentration of dissolved solids reduced, a method for curing and preventing the vast majority of foaming troubles in domestic steam boilers will have been found.

Precise Methods Needed in Heating Boiler Water Treatment

In dealing with this problem we must try to approach as nearly as possible the precise, scientific methods which prevail in power boiler practice, where water treatment is accomplished not by guess work, but by the application of definite chemical principles. It is well to note that there is a huge difference between the intelligent, scientific use of chemicals and their use when a sound knowledge of their properties is lacking. Thus we might cite the example that chlorine and copper sulphate, both of which are poisons, are introduced into our city drinking water to safeguard our health. Their use is based upon scientific knowledge of their effect. In all industries we can find examples of the use of chemicals ordinarily considered detrimental to other materials, but when used intelligently remarkable results are accomplished.

In treating boiler water, we also must study carefully the variable factors with which we have to deal. They are, first, the amount of water to be treated; second, the chemical analysis of the water, which varies widely in the cities of the United States. The chemical used must be provided in such quantities that (1) the soaps present are destroyed; (2) the soap-forming chemicals in the water are destroyed; (3) solids present in the water are precipitated, causing a great reduction in the calcium and magnesium hardness of the water; (4) a suitable excess is provided to take care of make-up water.

Soda and lye and similar compounds have long been used in an attempt to stop foaming by cleaning out the boiler. The results obtained are unsatisfactory unless a great amount of time and labor is expended. The effect of soda or lye is to dissolve the oils in the boiler, but in doing so large quantities of soap are formed, just as soap is made in a soap factory. The addition of these chemicals has been known to increase the priming coefficient of a boiler water, where oil was present, 250%.

The problem is then one of cleaning the boiler out by blowing off and flushing out. It is almost impossible in practice to remove all the soap and soda or lye.

In Fig. 3, we see how small a soap concentration is necessary to give an

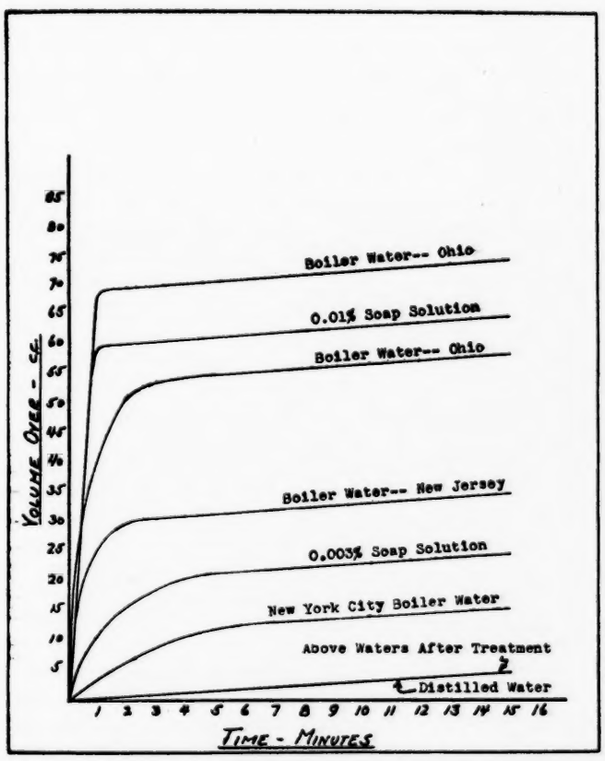


Fig. 2. Priming Coefficients for Various Percentages of Soap Concentration

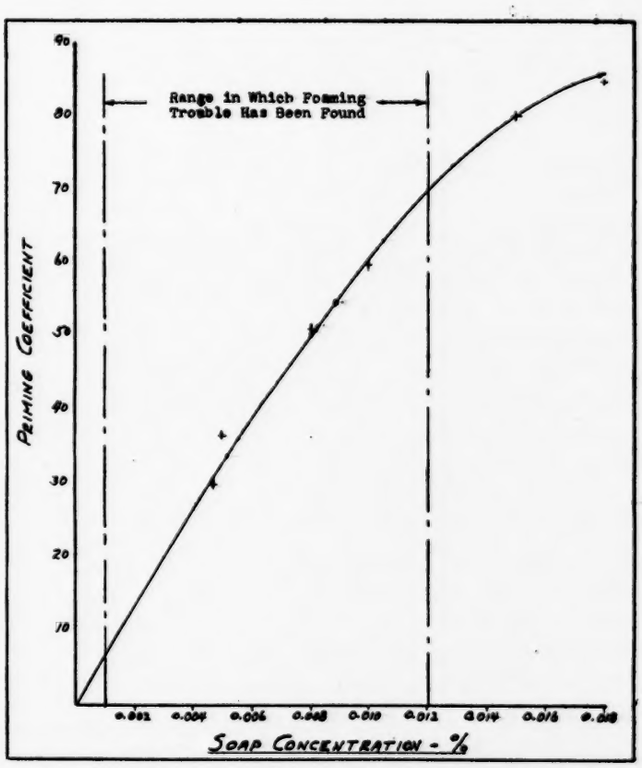


Fig. 3. Priming Coefficients of Waters from Various Localities as Compared with Distilled Water

aggravated foaming condition. The curve represents the variation of priming coefficient with the concentration of a standard soap solution. We see that actual boiler foaming has been observed where samples of water gave priming coefficients from 6 to 70, corresponding to soap concentrations from 0.001% to 0.012%.

Even if all the soap and soda or lye could be removed from the boiler, there is nothing to prevent oil from coming to the boiler from radiators and piping and causing the trouble all over again. Often, in fact, the experience of the steamfitter is that two or three weeks after he has cleaned out the boiler by this method, the trouble returns, and in many cases the condition is worse than it was before the boiler was cleaned, because of small quantities of soda or lye which remained in the boiler.

It is not rare to find a boiler that has been blown 10 or even 20 times, and even then the job is sometimes not cured. It is small wonder that the steamfitter is at his wit's end; he is exposed to the wrath of his customer and he quite naturally thinks that the trouble is with the boiler.

Appearance of the water alone is no indication of its priming coefficient. A dark brown, muddy water may not prime at all; a crystal clear water may have a priming coefficient of 60. If it is desired only to prevent foaming one procedure is followed; if it is also desired to clean out the boiler, the method must be altered. But we must always keep in mind what is going on in the boiler; what the effect of the chemicals we use is upon the substances present in the water; what their effect is upon the metals making up the heating system, both at the time of application of the treatment and through the following months or years. And in all these considerations we must be guided not by opinions or beliefs, but by the sound scientific principles involved.

Referring again to Fig. 1, we will find the priming coefficients of water samples taken from boilers in various localities. Thus a water from a town in Ohio has a priming coefficient of 70; another Ohio water gives 53; a New Jersey water gives 32; and so on. With means now available it is possible to stop the foaming condition in all of these waters and reduce the priming coefficient (or PC) to zero, which corresponds to Curve 1 for distilled water, and these results can be obtained through a minimum expenditure of time and labor, without blowing off the boiler.

Thus, the problem of the foaming and priming boiler is no longer enveloped in darkness. Its solution furnishes another example of the triumph of scientific investigation over our difficulties.

Determination of Dew Point of Flue Gases

In studying the corrosion of metals by flue gases, one of the questions of great importance is what is the highest temperature at which a liquid phase will exist on the metal surface in equilibrium with the gas. Such a liquid phase would influence the rate of corrosion not only because of the presence of a film of acid, but also because other corroding agents, such as a sulphate scale, will be brought into close contact with the metal, with a consequent better chance for reacting. In all probability the rate of corrosion would be greatest at the temperature of the dew-point, because of the combined action of the film and of the better contact of the scale.

Circular No. 20 of the Engineering Experiment Station of the University of Illinois describes a method of determining the dew-point of flue gases that is based upon new principles. An electrical device based on the conductivity of a glass surface is used. The accuracy of the instrument was found to be within 2° C. for low concentrations of sulphur trioxide and 10° C. for higher concentrations. A description of the apparatus and methods of testing are contained in the circular.

As a result of the study it was found that the concentration of sulphur trioxide greatly affects the temperature at which liquid will form. Data are presented to show that the sulphur trioxide in the furnace gases does not originate by oxidation of sulphur dioxide, but by the decomposition of the sulphates in the coal. It was found that a rough estimate of the dew-point may be made if the sulphur trioxide concentration, together with the usual Orsat data, is known for the gases.

Published by the Engineering Experiment Station, Urbana, Ill. Size 6 in. x 9 in. Pp. 22. Copies supplied without charge.

Second Annual Potomac States Plumbing and Heating Institute

Welding, costs of doing business, credits, electric heating, Gold Bond Plumbing and Certified Heating, were the topics emphasized at the second annual Potomac States Plumbing and Heating Institute, held in Washington, D. C., at Corcoran Hall, George Washington University, April 24-26.

Among the speakers was S. Lewis Land, educational director, Heating and Piping Contractors National Association, who gave a talk on "Education in the Trades." "Education," he said, "simply means managing your business on a profitable basis and keeping abreast of the times; regarding new fixtures and accessories manufactured for your trade. You must know something about credits, the cost of materials, how to buy, and also know the financial standing of those with whom you do business. Two new items that today are receiving the attention of the trade are welding and electric heating."

James H. Platt, engineer, quartermaster's department, War Department, spoke on "Refrigeration," and claimed that it is practically a heating proposition as regards its installation and should be controlled by the good heating contractors.

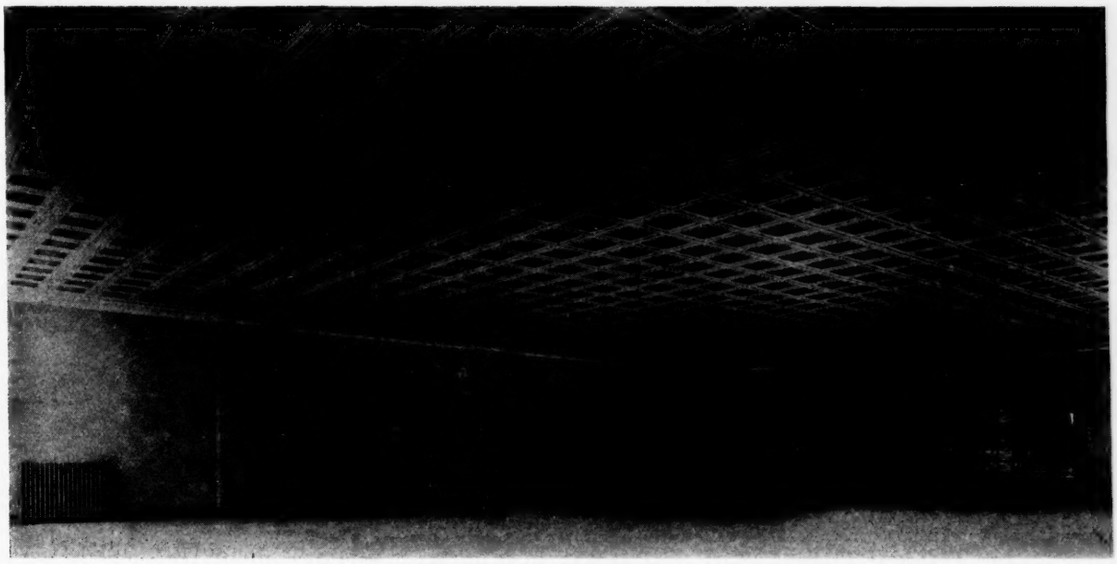
He explained by diagrams on a blackboard the methods now used to chill ice-boxes or rooms, and the manner in which air is changed. He predicted that in time a new way would be found to cool, heat, ventilate hotels, homes, and other public buildings, which would do away with windows that open, the windows to be used only for light. Also that every building would be fitted with air washing devices.

E. J. Febrey, past president of the Heating and Piping Contractors Washington, D. C., Association, was in charge of the evening session. He introduced Joseph C. Fitts, assistant secretary of the Heating and Piping Contractors National Association, who spoke on Certified Heat and Gold Bond Plumbing. Mr. Fitts stated that the members of his association found that guaranteeing their heating installations brought them many satisfied customers.

Another speaker was Walter B. Lawrence, whose topic was "Physics of Heating." Mr. Lawrence reviewed the style of heating used from the early day fireplace to the present time. He discussed the various conductors of heat, how flow is regulated, circulation, heating units, efficiency, evolution of heating equipment, exposed and concealed radiators, etc.

J. F. Barkley, fuel engineer, Bureau of Mines, discussed Small House Heating by Coal, and stated that in warm air, hot water, steam and vapor heating, results differed very little when coal of the same grade was used.

"Small House Heating by Oil" was the subject of a talk by Arthur H. Senner, mechanical engineer, U. S. Department of Agriculture, and "Small House Heating by Gas," was discussed by Herbert Gill of the Washington Gas Light Company. Mr. Gill stated that there would be more small houses heated by gas in the future than at present, due to the possibility of reducing the cost of the fuel, and advised that copper flues are more serviceable than those made of galvanized iron, after extensive tests. The relative merits of the three fuels then were discussed.



Arrangement of Direct Radiators in Showroom

Showroom and Garage Heating

by **W. WALTER TIMMIS**

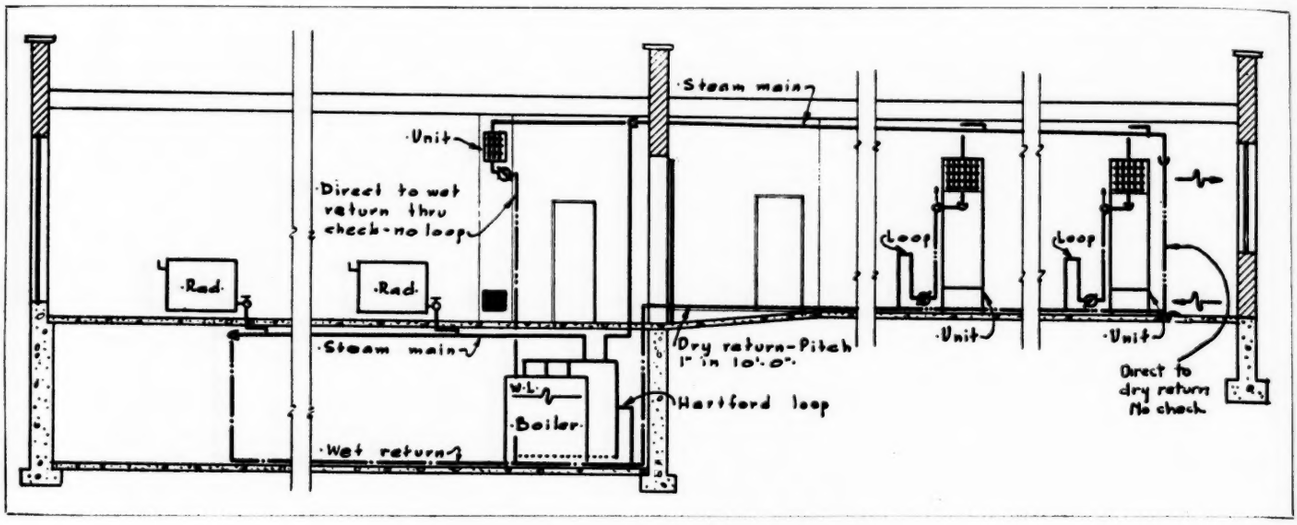
SHOWROOM and garage low-pressure steam heating and the securing of satisfactory results with a moderate installation cost, consitute a problem which has long been with us. The advent of the oil burner and the unit heater, instead of simplifying the problem, has served in many instances, to complicate it.

A time-honored method was to install radiators in the showroom and pipe coils in the shop. Coal, hand-fired, was the fuel in common use. Pressure generally was maintained in cold weather, and if it got too hot in the showroom, either the radiator valves were shut off, or the doors and windows opened. The method worked, after a fashion. At least there was heat both in showroom and shop, even if there was often too much. However, it was wasteful and the necessary firing was a nuisance.

With the advent of the oil burner immediately the problem of control came up. If a thermostat was used and placed in the showroom, as it generally was, the condition in the shop was not reflected at all. Showrooms generally are over-radiated, and the thermostat in the showroom is satisfied long before the shop is up to temperature. If a pressure control was used, it resulted in overheating most of the time.

Then came the unit heater and enthusiastic salesmen got them in the shops because of lower cost and space saving. The unit heater motor was controlled either by a manually-operated switch or by a thermostat. This result-

Unit Heaters in Garage Back of Showroom



Diagrammatic Section Through Heating Plant

ed in a very serious difficulty. Unit heater fans frequently were turned on when there was no steam pressure. Unit heaters are very well adapted to this type of heating but it is absolutely necessary, for their successful operation, to have constant steam pressure.

If constant steam pressure is maintained and sufficient radiation is installed in the showroom to heat it to 70° F. in zero weather, it will be overheated most of the time. Generally the installation of a temperature-control system in the showroom radiators is impossible because of the cost. Such an installation would involve not only the temperature-control apparatus, with air compressor, piping, thermostats, valves, etc., but also the installation of a two-pipe system, with thermostatic traps and a boiler-return pump. The pump is necessary because a pressure of from 3 to 5 lbs. gauge should be carried at all times for the successful operation of the unit heaters. Under these conditions, a boiler-return trap could not be used to return the water of condensation to the boiler.

Recently the writer designed heating plants for two such buildings in which all the elements of this problem seem to have been met successfully. The cost of installation was very moderate. A constant temperature of 70° F. in the showroom and 55° F. in the shop prevails at all times during the day. The fuel cost is exceptionally low.

Direct radiators, supplemented by a unit heater, are used to heat the showroom. About 60% of the showroom requirements is met by direct radiators, and 50% by the unit heater. Note the 10% excess. Unit heaters are used to heat the shop.

The direct radiators are supplied by a one-pipe system, while the unit heaters are supplied by a two-pipe system. An oil burner is used, controlled by a thermostat placed in the showroom. This thermostat is in series with a pressure control on the boiler. Thermostats control the unit heater fans. They are in series with three-point speed controllers, manually-operated. The Thermostat for the showroom unit heater is mounted in the showroom and the thermostats for the unit heaters in the shop are mounted in the shop on the wall opposite the unit heaters. Each unit heater has its own thermostat.

Operation of the system is as follows: Oil-burner thermostat in the showroom is set at 72°, while the unit heater thermostat is set at 70°. Inasmuch as there is insufficient direct radiation in the showroom to heat it to 70° in most weather, the unit heater is called on, intermittently, to bring the showroom up to temperature. In actual operation, it operates about three times an hour for a total time of 15 min. per hr.

Remember that the oil-burner thermostat is set for 72° and consequently, it is never satisfied, except as will be noted later. The result is that the oil burner operates on the pressurestat, not on the thermostat. Consequently, there is a constant steam pressure, but no overheating of the showroom. The unit heaters in the shop are turned on when their respective thermostats call for heat, and are shut off when the thermostats are satisfied. Speed controllers in the unit heaters are operated by the building occupants. Full speed is used for heating up in the morning and medium and low speeds are used after the heating-up period in accordance with the weather.

Of course there are days, especially in the Spring and Fall, when the direct radiation in the showroom will be sufficient to heat it. The temperature outdoors will be 50° to 55°, in which event no heat is necessary in the shop. In that case, the oil-burner thermostat controls the system, none of the unit heaters being called upon.

All the unit heaters are of the recirculating type, cold air being drawn in at the floor and warm air being discharged horizontally at a level of about 9 ft. above the floor. In the showroom the ceiling height is 12 ft. and in the shop, 14 ft. There are no drafts, cold spots or hot spots. Between floor and ceiling the temperature difference does not exceed 4°. The unit heaters in the showroom are installed in the toilets, so that only the inlet and discharge openings are visible in the showroom.

A combination of the one-pipe and two-pipe systems was worked out in an interesting manner, which has proved entirely successful in operation. It will be noted from the sketch that the end of the steam main feeding the shop unit heaters is dripped directly into a dry return, and that the returns from these unit heaters pass through a check valve and seal into this same return line.

The pressure drop through the unit heater is negligible, therefore, both sides of the seal are subjected to equal pressures and the seal stays in balance. The seal need not be more than 12 in. deep. Incidentally, this return line, being dry until it reaches the boiler room, must be well pitched. Also, the top of the seal should be kept about 12 in. below the bottom of the unit heater radiator, to allow for a sufficient head of water to keep the check valve open.

The return from the unit heater in the showroom, is taken through a check valve directly to the wet return in the boiler room. No seal is, or should be used. The check valve should be about 12 in. below the bottom of the unit heater radiator, for the same reason as stated above.

B. T. U. Club

Every reader of HEATING AND VENTILATING, *whether a subscriber or not, is a member of this club. There are no initiation fees or dues. There is not even a constitution. The club functions as a forum or round table for the informal discussion by our readers, particularly the younger men in the industry, of topics in which they are interested, provided only that such topics pertain directly or indirectly to heating and ventilation. If you prefer, your name will not be used.*

Heat Loss Through Double Glass

Prof. F. B. Rowley,
Director, Experimental Engineering
Laboratories, University of Minnesota.

In connection with the use of double glass windows to reduce heat losses, a contributor maintains that with an air space between two sheets of glass, and with still air conditions on both sides of the double sheets, the temperature of the confined air must find an equilibrium at a temperature which will be a mean between the inside and outside temperatures. This our contributor states to be an absolute necessity since the areas of the two sheets of glass are the same and since the heat transmission through a sheet of glass with still air conditions existing on both sides is dependent on the temperature difference between the air on each side. In other words, the heat head is equal to K (T_1–T_2), when K is the transmission constant and T_1 and T_2 are the inside and outside temperatures. If this is correct, our contributor states, then the heat head for the two sheets of glass must be the same, for the same amount of heat is passing through both sheets under the same conditions and in the same unit of time.

If the above assumptions are correct, then the only condition which would permit an equal transmission would be one in which the temperature of the confined air between the two sheets is at a mean between the inside and outside temperatures.

For example, according to this reasoning, the heat loss in B.T.U. per hour (based on your experiments with one thickness of glass and the use of the coefficient 0.887 B.T.U. per sq. ft. per hr. per degree difference in temperature) for a window of 1 sq. ft. area and temperatures of 0° and 70° would be

$$0.887 \times (70 - 0) \times 1 = 62.09$$

With a window of two sheets of glass, set at a spacing of ¼ in., and assuming a temperature in the confined space at 35°, the heat transfer in B.T.U. per hour for the inner sheet would be

$$0.887 \times (70 - 35) \times 1 = 31.05$$

and the same calculation for the outer sheet shows that the same amount of heat passes through this sheet. Inasmuch as the transmission is just one half that through a single sheet it naturally follows that the coefficient for the double glass is just half that for one thickness, or 0.887 divided by 2 or 0.4435.

Yet, according to your tests, this figure was never obtained. The nearest was 0.457 for a 2½ in. spacing of sheets.

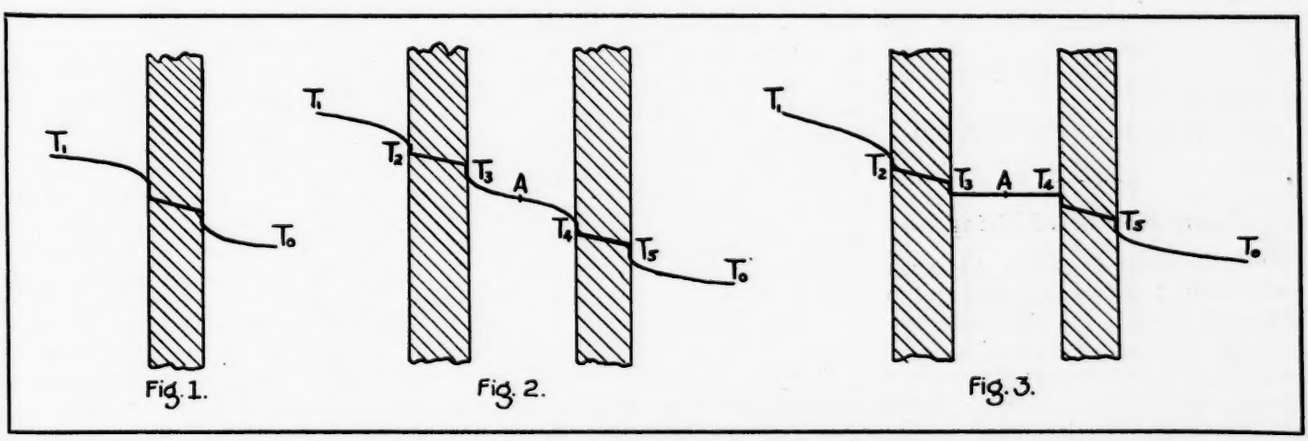
Our contributor also states that, in his opinion, interior circulation would be set up when the sheets are spaced over 1 in. apart, and that such circulation, doing away with the still air conditions, would result in a more rapid transmission of heat. If this were true then the coefficient for double glass spaced more than 1 in. apart would be more than for the glass spaced less than 1 in. According to your tests, just the reverse is true —the closer the sheets, the higher the coefficient.

Will you be kind enough to give us an explanation of this?

MR. CHAIRMAN:

The best way to answer the questions in regard to the insulating value of the double glass with air space between, would be to refer to **Figs. 1, 2 and 3.** Fig. 1 represents a single thickness of glass. The temperature gradient from the air on one side to air on the other side would be represented by the solid line T_1, T_o. As we come nearer to the glass, approaching from the left, the temperature drops until, in the surface of the glass, there is an additional straight line drop, due to the surface resistance. From this point the temperature gradient gradually drops until the right hand side surface is reached, where a small drop will be necessary to force the heat through the surface and then there will be a gradual drop to the air temperature. The actual surface drop represented by the straight line in each surface is really very small. More of the temperature drop is in the air as we approach and recede from the glass.

For double glass with an air space between, the temperature drop would be represented by the line T_1 T_o of **Fig. 2.** The center point on this line marked "A" will be the mean temperature be-



Figs. 1, 2 and 3. Temperature Drop Through Glass

tween T_1 and T_0, provided the air conditions are the same on both sides of the test specimen. If the air between the two thicknesses of glass could be maintained in a quiet condition, the line $T_2 T_4$ would be a sloping straight line. Since this air naturally sets up eddy currents, due to the difference in temperature between the two sides, the line $T_2 T_4$ is a curved line as shown. If the air space is increased in thickness, the drop from T_2 to T_4 will be increased, due to the resistance against straight conduction, but on the other hand, as the space is increased, the air circulation will become more vigorous and more heat will be carried from T_2 to T_4 by convection.

Thus, as the air spaces increase there are two conflicting conditions set up. The resistance to conduction is increased, due to the increased thickness of the air space, but the convection currents also are increased, giving more rapid transfer of heat as the space is increased. The increase of resistance, due to the first cause, overbalances the decrease due to additional convection currents, until about ⅝ in. to ¾ in. space is reached. After this the major part of the heat is carried across by convection and there appears to be very little difference in the result from varying the width of the air space above ¾ in.

If it were true that the heat loss were arrested only by the double thickness of glass, then the temperature gradient from air to air through the double glass would be represented by the solid line of Fig. 3, that is, the temperature of all the air between the glasses would be the same and equal to the mean temperature between T_1 and T_0. This can not be the case as there would then be no heat potential to force the heat across the air space.

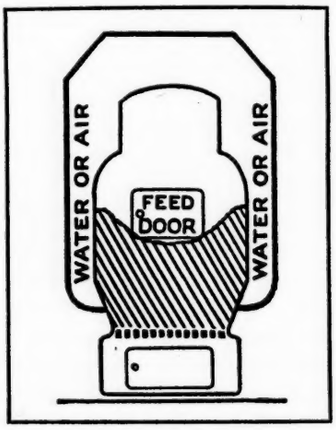
I think the point which is confused by many is that the temperature of the air space is not equal from one side to the other, but that it gradually drops as shown in Fig. 2. If this were true, the air space in itself would have no thermal resistance and the heat would flow from one side to the other without a drop in temperature, which is an impossibility.

Minneapolis, Minn. F. B. R.

Crater Method of Firing

The accompanying sketch shows the crater method of firing as illustrated in a booklet recently issued by a prominent anthracite coal company. The booklet states that this method of firing is a recent development in more efficient and economical firing worked out by the company's research laboratory.

In the diagram showing the crater method, the coal is heaped against the walls of the fire-pot with a low center which is level with the bottom of the feed door. The easiest passage of the draft through the fire bed is naturally along the walls, hence by carrying the fire higher along the side walls, the too easy passage of air is retarded, maintaining a uniform draft throughout the fire-bed. This keeps the large body of



Crater Method of Firing

heat in close contact with the water or air to be heated. The advantage of this method of firing is said to be that there is more contact of the fire with the actual heating surface and it is recommended for all household heaters not equipped with a magazine feed.

The chief engineer of a well-known boiler and furnace company has sent us the following comments on this method of firing:

"The crater method of firing is good and is what I have used for many years when long firing periods were desirable or necessary. This method is particularly good in round boilers, and works very well in the square type.

"I do not agree that it is the best way to fire a warm-air furnace of the usual type, that is in those having the flaring fire-pot. This type of warm-air furnace has a tendency to hold the ash up, due to the angle of the sides of the fire pot, which retards the rate of combustion around the outer rim of the fuel bed. The air admitted for combustion under the grate has a tendency to settle upwards to the fuel bed in a rather straight line, resulting in a higher combustion rate in that part of the fuel bed slightly above the grate. The rate of combustion is thus quite uniform for the area equivalent to that of the grate.

"It is my opinion that in the case of the usual cast-iron warm-air furnace the crater method should be reversed. This is my conclusion after having observed the behavior of many furnaces under varying conditions of care and drafts."

Another engineer writes as follows:

"The crater method of firing would work nicely on any line of boilers or furnaces having finger bars around the fire box through which air may work up the sides without the resistance caused by a bed of ash at the grate line.

"The writer's experience with warm-air furnaces is exactly the reverse from such a method. Any furnace or boiler having the fire pot larger at the top than the bottom has a tendency to hold fine ash on the walls, which do not clean easily. Therefore, whenever the grate is agitated there is less resistance to air passing through the center than to the air at the outside with the result that the fire burns out faster in the center. The fuel base should be heaped up in the center rather than at the outside."

The engineers quoted seem to think that while the crater method of firing is worth while so far as boilers are concerned, it is not a good method in warm-air furnaces. Members of the B.T.U. Club who have had experience with either or both of these types of heaters are invited to send in their comments on this method of firing.

The Manufacturers' Part in the Advance of the Industry

MR. CHAIRMAN:

It is no secret that the present interest in modern heating and ventilating displayed by the public is not due to any propaganda on the part of the contractors and dealers. On the contrary, it is all due to a group of leaders in the heating and ventilating manufacturing industry. In other words, the manufacturers have done their part in making the country "air conscious." Consequently the contractors and dealers have been placed in a position where they can make money in selling heating and ventilating appliances, such as, for instance, electrically or power-operated ventilating systems.

In previous times there were only a few persons in the contracting business, as compared to the thousands who are known today as heating contractors, and they certainly did nothing in the way of increasing the public interest. They would sell, according to our analysis, any kind of a makeshift system. Sometimes it worked, but most of the time it was questionable, and therefore the public's confidence in the layman's recommendation was not any too great.

It became necessary for the large manufacturers to experiment and standardize on systems, and then set forth to merchandise the ideas. We believe it can be said with definite certainty that merchandising today has done more for increasing the ventilating fan business as

a whole, than any other single method. This of course, goes hand in hand with national advertising.

It is the writer's personal contention that heating and ventilating contractors should not take an inquiry and juggle it to their selfish interest or satisfaction. When a manufacturer sends them an inquiry, they should at least sell that manufacturer's equipment, regardless of the margin of profit they may make.

It generally is known today that there are a lot of newcomers in the heating and ventilating manufacturing business, and their only means of getting on is to talk margin of profit, rather than volume of business. That is, they will dangle the big margin before the eyes of the contractors and dealers, who forget that their business was built up largely because of the pioneering done by manufacturers who are offering them a good and reasonable discount.

Many contractors hold up some of the newer manufacturers' discounts in a competitive way, which would not be so bad if the latter went out and created some of their own business. What rubs against the grain is when the contractors take this new manufacturer's figure or discounts and try to make the old-line manufacturer meet the same on specification jobs which the old-line manufacturer has created.

In other words, we believe that contractors as a class do not go to architects, engineers or building owners and create a demand for heating and ventilating equipment. That is done principally by the manufacturer.

It is the writer's opinion that as soon as a manufacturer departs from certain principles, the contractors quickly make capital of it. By the same token, we believe, it is up to the profession to urge the same spirit of fairness and cooperation on the part of the contractors and dealers.

It is a fact that many contractors attempt to make legitimate manufacturers compete in price with products that are distinctly inferior. For instance, let us say that concerns which we will call A, B and C, have an outstanding protective dealer and contractor policy. They, in turn, create a lot of specifications for heating equipment. The contractor figures on these jobs, and along comes some competitors, known as X, Y and Z, whose general policy is to sell everybody and anybody, regardless of the consequences. The contractor, without considering ethics, or pioneering and the meaning of a good policy, compels manufacturers A, B and C, to compete with the irresponsible manufacturers, X, Y, and Z.

There is also the item of credit. Very often, when the responsible manufacturers hold certain contractors to specific credit terms, the contractors enter into business relations with irresponsible manufacturers and do everything possible "to switch the demand." To my mind, I feel the time is here for a definite code of ethics to be adopted by the heating and ventilating contractors. The manufacturers, also, should be induced to adopt a creed which, both in spirit and letter, would tend for fair trade practice and a protective trade policy.

I sincerely believe in competition, and am not trying to change the old expression of "it being the life of trade." I say, however, that there are two kinds of competition. Which does the contractor and dealer prefer to support? If he will make his decision in favor of the former, we believe he not only will make more profit by reason of volume, but will gain the whole-hearted support of the responsible manufacturers. If he decides to ride with the latter, he is only inviting some more competition within his own ranks, because the manufacturers will decide either to sell direct, or to establish chain outlets for their products.

Saving 50% of the Fuel Bill

The B. T. U. Club is indebted to C. M. Lyman of the International Heater Co., Utica, N. Y., for the following:

MR. CHAIRMAN:

However much modern heating apparatus may have been modified, our descriptive vocabulary apparently has remained unchanged over a period of years. This was brought forcibly to my attention while perusing a newspaper almost 30,000 days old.

The paper is a copy of the "New York Morning Express" of August 20, 1849. There are four pages, 22 in. x 27 in., nine columns set solid with fine type and no startling head lines and almost no leading or spacing.

In the advertising columns we find the statement "three cambooses for sale." Can you young men in the heating industry guess what they were? They were cook stoves used on a canal boat or coasting vessel.

Another advertisement is for a concern at 37 Bowery, with a one-inch ad of a firm of "Gas Fitters and Plumbers." At 168 Greenwich St., R. Sumner offers to put on metal roofs on short notice and warranted tight. He also advertises sheet metal bathing tubs to order.

Perhaps the most interesting of all, however, is a 5 in. single column advertisement on the first page, the only illustrated publicity in the paper, except the tiny conventional house, ship and canal boat cuts that appear in the classified notices. The advertisement is that of D. Griffin & Company's patent fuel saving apparatus. Somehow it seems very familiar in its opening paragraph. "Engineers need not be informed that from 30 to 50% of the heat produced has usually been lost even by the most economical setting of steam boilers, and the remark applies as correctly to nearly all furnaces."

Omitting some remarks about patents and applications the advertisement goes on to state that "the principle has been tested by business men of the highest respectability who have realized a saving of from 30 to 50%. It differs from other methods of consuming fuel, inasmuch as by it the combustion is rendered perfect, the smoke and gases are nearly all burned and a given quantity of fuel, whether wood or coal is thus made to produce its maximum amount of heat."

Doesn't all this have a modern 1930 ring? Further, "when the incombustible gases pass into the chimney they are at a temperature incapable of boiling water and consequently useless" and "an artificial draught is substituted for the natural, and the necessity of building high chimneys entirely obviated, materially reducing the cost."

If you are not convinced of the truth of all this, the report of the Committee on Arts and Science of the American Institute is added which states that "the committee are of the opinion that this plan embraces the best application of natural laws to the economical combustion of fuel of any plan which has been exhibited to them."

And to clinch the whole argument a list of references set in 5½ point type follows.

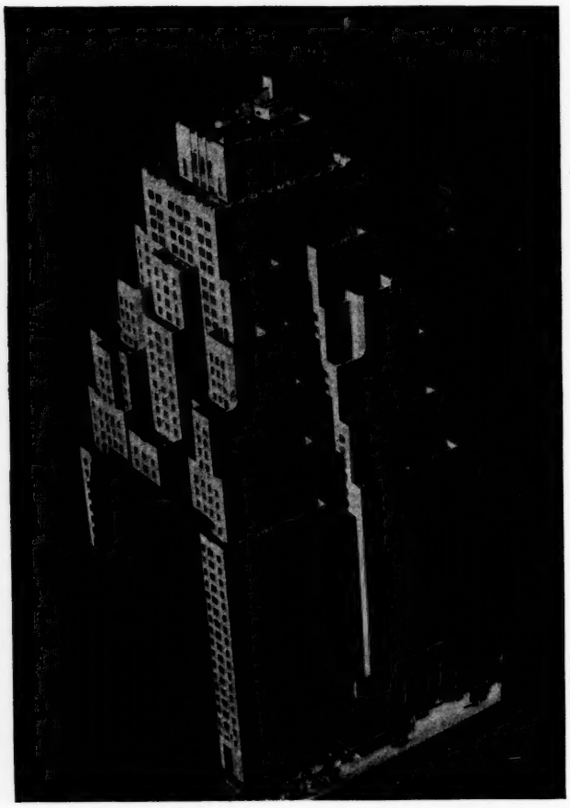
Unfortunately, while the typographical work is excellent and the paper stock of splendid quality the illustration of this remarkable fuel saver is so indistinct that it is impossible to decide of what its particular merit consisted.

Natural Gas Piped from South to Illinois

The first natural gas transported by pipe lines to Illinois is now being sold in East St. Louis, it was announced at the office of the Illinois Commerce Commission May 10.

It is understood that certain surveys are being made and other preliminary work done for the construction of natural gas-pipe lines from the Louisiana or Texas and Oklahoma fields to and through Illinois.

Plans of the Missouri-Kansas Pipe Line Company were said to contemplate a 930-mile gas line from Amarillo, Tex., to the central part of Indiana, passing through Illinois, at a cost of nearly $40,000,000.



The New Yorker Hotel, 34th Street and Eighth Ave., New York
Convention Headquarters for the H. & P.C.N.A.

New York to Greet Heating Contractors

ADDRESSES by nationally-known speakers, discussions from the floor on such subjects as standards, certified heating, welding, trade resolutions and trade promotion, together with reports of officers and of chairmen of committees, are highlights of the 41st annual convention of the Heating and Piping Contractors National Association, which will be held in New York, Monday to Thursday, June 16-19, inclusive. Headquarters will be at the New Yorker Hotel at Eighth Avenue and 34th Street, just north of the Pennsylvania Station.

In addition to a meeting of the board of directors, June 16, the Secretaries' Conference will be held that day at 10 o'clock. This conference has come to be recognized as one of the most important activities of the association, as it constitutes the forum for the discussion of trends of the industry, as well as of problems of local association management.

At the first general session, Monday afternoon, the convention will be addressed by Mayor James J. Walker on behalf of the City of New York and by President Robert B. Miller of the Heating and Piping Contractors New York City Association, who will extend the welcome of the local association.

After responding to the welcomes of the city and local association, President Walter Klie of Cleveland will deliver the president's address.

An important feature of the program for that day will be an address by John C. Howell, an economist of note, who will speak on the subject of "What is Ahead of the Heating and Piping Contractor?"

One of the outstanding reports will be that of the Committee on Standards of which Ralph S. Franklin, of Boston, is chairman. Mr. Franklin will tell of the new edition of Engineering Standards which will be an extension, rather than a revision, of previous editions and will give the heating industry many data on the new types of construction and of insulated buildings which were not included in the former standards. Also a new type of radiation estimating table will be included in this report.

Other reports which will be awaited with more than ordinary interest are those of the Subcommittee on Boiler Output, George M. Getschow, chairman; Committee on Certified Heating, A. R. Thompson, chairman, and of the Subcommittee on Welding, John H. Zink, chairman.

Tuesday afternoon will be devoted to a trip up the Hudson on the Hudson River Day Line to West Point. Dinner will be served at the Thayer Hotel, West Point. This trip will be in charge of William J. Olvany, president of the New York State Association, and his entertainment committee.

Wednesday, June 18, will be devoted entirely to the discussion of trade promotion, starting with the report of the Committee on Trade Promotion, of which Herbert A. Snow, of Boston, is chairman. During the past year the committee has been studying fundamental problems, such as the relations of heating contractors with jobbers and manufacturers. Walter H. Oleson, manager of the Heating and Piping Contractors Boston Association, will tell the convention what he believes can be done in building up a cooperation between heating contractors and their sources of supply.

Trade rules as they affect the heating industry also will be discussed. Both the rules of the National Plumbing and Heating Industry, as well as the possibility of formulating rules covering the contractors' affairs, will be brought up.

In its early studies the Committee on Trade Promotion discovered that conditions governing the granting of credit were rather chaotic. Four principles

which the committee has formulated governing the granting of credit will be brought before the convention for discussion. These principles which could be recognized as a national basis of credit, are as follows:

1. The ability of the applicant for credit to furnish regular financial and operating statements.

2. The ability of the applicant for credit to operate his business successfully on a volume which is within the limits indicated by proper consideration of capital and operating expense.

3. The possession by the applicant for credit of technical knowledge, craftsmanship and business ability to successfully execute the various projects undertaken by the concern.

4. Habits of payment of the applicant for credit as shown by interchange of information between various sources of supply.

"Selling Certified Heating to the Architect and Engineer," by George B. Richmond, secretary of the Heating and Piping Contractors Memphis Association has been scheduled for this session, since selling is part and parcel of trade promotion.

"The Value of Facts in Laying out the Association Program" will be discussed by Victor L. Peavy, executive manager of the Heating and Piping Contractors Minneapolis and St. Paul Associations.

Interesting facts developed in a survey of the heating industry conducted by Assistant Secretary Joseph C. Fitts, will be presented at this session.

The concluding address of the session will be made by Homer J. Buckley on the subject of "Trade Promotion in the Heating Industry."

Wednesday afternoon will be devoted to practical sales demonstrations. Here the membership will have an opportunity of watching a heating contractor actually sell certified heating to a homeowner and his wife. Another problem which will be placed before the meeting is selling an owner with his architect present. Here again a real heating contractor will face actual prospects. Dr. F. R. Cawl, merchandising expert of the Philadelphia *Public Ledger* will direct the demonstration and give a brief talk on the principles of selling. He also will comment on the work of those who have tried to make the sale.

The annual convention dinner and dance wil be held Wednesday evening at the New Yorker Hotel.

Following is the program in full:

Monday Morning, June 16

Registration of delegates.
Meeting of Board of Directors.
Association Managers' and Secretaries' Conference.

Monday Afternoon, June 16

General session.
Address of welcome, Mayor James J. Walker of New York.
Welcome to New York, President Robert B. Miller, New York City Association.
Introduction of past presidents.
President Walter Klie's address.
Appointment of Convention Committees.

Tuesday Morning, June 17

Report of Treasurer Robert D. Williams.
Report of Secretary Henry B. Gombers.
Report of Membership Committee, Ray L. Spitzley, chairman.
Report of Committee on Standards, Ralph S. Franklin, chairman.
Report of Sub-Committee on Boiler Output, George M. Getschow, chairman.
Report of Sub-Committee on Welding, John H. Zink, chairman.
Report of Committee on Certified Heating, A. R. Thompson, chairman.
Discussion of reports.

Wednesday Morning, June 18

Report of Committee on Trade Promotion, Herbert A. Snow, chairman.
"Cooperation of Heating Contractors with Jobbers and Manufacturers," Walter H. Oleson, manager, Heating and Piping Contractors Boston Association.
"Trade Rules as They Affect the Heating Industry." A discussion of the portion of the report of the Committee on Trade Promotion on this subject.
Principles Governing the Granting of Credit in the Heating Industry submitted for discussion.
"Selling Certified Heating to the Architect and Engineer," George B. Richmond, secretary, Heating and Piping Contractors Memphis Association.
"Value of Facts in Laying Out the Association Program," Victor L. Peavy, executive manager, Heating and Piping Contractors Minneapolis and St. Paul Associations.
Survey of the Heating Industry, Joseph C. Fitts, assistant secretary.
"Trade Promotion in the Heating Industry," Homer J. Buckley.

Wednesday Afternoon, June 18

Sales Demonstrations.
Selling of "Certified Heating" to a homeowner and his wife, and selling to an owner in the presence of an architect. Demonstrations under the direction of Dr. F. R. Cawl.

Wednesday Evening, June 18

7:00 P. M. Dinner and Dance.

Thursday Morning, June 19

Reports of convention committees.
"Publicity in the Heating Industry," Norman J. Radder, publicity director, Plumbing and Heating Industries Bureau.
Election and installation of officers.

Annual Meeting of Wisconsin Heating Contractors

A resolution asking the assistance of Governor Walter J. Kohler of Wisconsin in securing the separation of mechanical equipment from general contracts on state and municipal work, together with a resolution suggesting the removal of the Heating and Piping Contractors National Association headquarters from New York to Washington, D. C., were features of the 24th annual convention of the Heating and Piping Contractors Wisconsin Association, held at Sheboygan, April 14 and 15.

President C. P. Finke, of Sheboygan, commented on building conditions with the statement that: "Those who have studied conditions know what has happened, and what is happening now, and the obstacles that tended to retard building are being removed. Bonds are selling above last September levels, and a more stable basis of living and of conducting business is evident. Those who make a study of economic conditions are unanimous in their predictions that resumption of building will be sufficient to insure a good year."

One of the highlights of the meeting was a session devoted to educational work. National Director John H. Zink, of Baltimore, addressed the convention on the subject of pipe welding, in which he gave details of the work being done by the Sub-Committee on Welding of the National Association. He then led a three-hour discussion on the same subject which was characterized as the most instructive session the association has ever held.

Other speakers at the meeting were Carl J. Marsh, manager of the Milwaukee Association, whose subject was "Trade Practice Conference"; and E. L. Flentje, manager of the Plumbing and Heating Industries Bureau, who gave a comprehensive talk on "How to Sell."

Field Representative Edward G. Byrd led a round-table discussion on "Certified Heat." It was voted to have a committee appointed to work out plans for making certified heat available in every city and town in the state.

The officers elected are: President, C. P. Finke, Sheboygan; vice-president, C. A. Hooper, Madison; secretary, A. F. Bowers, Milwaukee; sergeant-at-arms, Michael Mueller, Milwaukee.

The directors are: F. D. Branson, La Crosse; William Neitzinger, Racine; George Reeke, Green Bay; Henry Mc-

Nulty, Milwaukee; Matt Younggreen, Kenosha, and John Engle, Appleton.

The afternoon and evening were given up to an inspection of the Kohler Company's plant at Kohler, Wis.

Vigus to Manage Northern California Association

K. C. Vigus, formerly with the American Radiator Company in a sales capacity, in the Sacramento and San Joaquin Valley territory, has been appointed to manage the Heating and Piping Contractors Northern California Association, Inc. Thomas C. Douglass, who held this post of manager since the formation of the association two years ago, has become associated with the James A. Nelson Company of San Francisco.

Special Air Conditions Supplied for Plant Research

The Boyce Thompson Institute for Plant Research was founded about six years ago through the generosity of Col. William Boyce Thompson. Located in Yonkers, N. Y., this institute, is carrying on valuable research on many phases of work on food, fiber, lumber and ornamental plants, according to *The Sibley Journal of Engineering*, published by students of Cornell University.

Two 60 H.P. return tubular hand-fired boilers constitute the heating plant, and are capable of operating at 100 lbs. pressure per sq. in. The heating system of the main building consists of ordinary standard radiators, and in the greenhouses are pipe coils receiving and heating from the boilers, the return being carried back through a vacuum return system to which two centrifugal vacuum return pumps are connected. The return is fed back in the boilers, so that very little make-up water is ever required. In addition to the heating system there is a high-pressure steam system, the generators being one 60 H.P. and one 25 H.P. return tubular hand-fired boiler operating at 75 lbs. pressure. These boilers furnish the power for steam-driven pumps in the refrigeration room and steam for the sterilization of soil.

A source of carbon dioxide properly scrubbed and filtered is essential for experimental work. In the Boyce Thompson Institute the flue gases are taken from the boiler furnaces, carried first through a steel tower equipped with sprays by which the gases are washed and cooled, then passed to a second tower using a mixture of sodium carbonate and permanganate solutions, and then to a smaller washing tower in which water is used. After this liquid washing and treatment, the gas is passed through four compartments containing various filtering elements, such as coarse and fine sawdust, cotton, wool, etc. The gas is drawn by a gas booster (tightly enclosed fan) from these compartments and driven through mains direct to the greenhouses, where it is used in experiments to determine the effect of carbon dioxide on growing plants. During the summer season this gas can be pumped to outside gardens by means of connections made to the exhaust of the fan.

Three 15-ton absorption refrigeration machines are installed. This refrigeration is used for cooling calcium chloride brine, which is circulated throughout the building to the various ice boxes and cold rooms. In conjunction with these machines there are four thermostatically controlled chambers, giving a range of temperature requirements from room temperature to approximately 10° below zero. The cooling water for dehumidifying purposes obtains its refrigeration by being sprayed over coils of pipe in which direct expansion of the ammonia is allowed to take place.

As the condition of air is an important factor in the operation of a plant of this type, a humidifier has been installed to increase the humidity in the air to a certain range of greenhouses. The temperatures at the saturation point of the air and also at the heaters in the risers to the various greenhouses are controlled by thermostatically operated valves, the actuating medium of these valves being compressed air.

A vertical motor-driven air compressor located in the basement of the building furnishes the compressed air, and an automatic switchboard maintains the minimum and maximum pressures.

R. C. Thompson, the mechanical superintendent, has 20 men working under his supervision in the institute.

Flue-Gas Scrubbers for Washing CO_2 at the Greenhouses

American Society of Heating and Ventilating Engineers

Program for Summer Meeting

GAS heating, air conditioning, heat loss, pipe sizing, oil burning and garage ventilation are among the subjects to be presented at the summer meeting of the American Society of Heating and Ventilating Engineers in Minneapolis, June 24-27. Registration opens at 8:10 A.M., Tuesday, June 24, at the Curtis Hotel.

Technical Sessions

Tuesday, June 24, 9:30 A.M.

Greeting by E. A. Jones, president, Minnesota Chapter.
Response by President L. A. Harding.
Report of Committee on Meeting Programs by A. C. Willard, chairman.
Control Equipment for Gas-Burning Appliances by W. E. Stark.
Economic Use of Steam in Modern Buildings by F. A. Gunther.
Report of Guide Publication Committee by D. S. Boyden, chairman.

Wednesday, June 25, 9:30 A.M.

Report of Committee on Research, F. B. Rowley, chairman.
Report of director of Research Laboratory, F. C. Houghten.
Surface Conductances as Affected by Air Velocity and Character of Surface by F. B. Rowley.
Wall Surface Temperatures by A. C. Willard and A. P. Kratz.
Comfort, Wall Temperatures and Insulation by Paul D. Close.

Thursday, June 26, 9:30 A.M.

Report of Committee on Oil-Burning Devices by L. E. Seeley, chairman.
Report of Committee on Pipe Sizes for Heating Systems by H. M. Hart, chairman.
Capacity of Return Mains for Gravity and Vacuum Steam Heating Systems by F. C. Houghten.
Loss of Head in Submerged Orifices by F. E. Giesecke.
Air Infiltration through Various Types of Wood Frame Building Construction by G. L. Larson and D. W. Nelson.

Friday, June 27, 9:30 A.M.

Report of Committee on Garage Ventilation, E. K. Campbell, chairman.
Carbon Monoxide Concentration in Garages by A. S. Langsdorf.
Report of Committee on Air Cleaning Devices by O. W. Armspach, chairman.
Report of Committee on Air Conditions and their Relation to Health, W. H. Carrier, chairman.
The Application of Air Conditioning to Premature Nurseries in Hospitals, by C. P. Yaglou, Philip Drinker and K. D. Blackfan (Presentation by W. H. Carrier).
Report of Nominating Committee.

Minnesota Chapter's Call to Minneapolis

As Sounded by
President Edward F. Jones

By the shores of Minnetonka
By the shining big sea waters
Dwells the Minnesota Chapter
Of the A.S.H. & V.
Here the braves of this society
Stand and beckon by the wayside
Beckon to their scattered warriors
To assemble here together.
Come and hearken to the big chiefs
Gain more knowledge and more wisdom
Exchange views that bring achievement
Meet your old friends and make new ones.
Bring the squaws and join the war dance
Feast and frolic here together
Choose this spot for your vacation
Come and see our land of beauty
Minnehaha, Laughing Waters
In the land of MINNESOTA.
(With no apologies to Longfellow)

Entertainment Program

Monday morning, June 23

Headquarters, reception committee, La Salle Hotel, Chicago.

Monday afternoon, June 23

Reception of members and guests by committee, Curtis Hotel, Minneapolis.

Tuesday, June 24

11:30 A.M. Picnic luncheon, Lake Harriet
2:00 P.M. Sightseeing and inspection, Twin Cities and University of Minnesota, Engineering Laboratory, plant of Minneapolis-Honeywell Regulator Company.
7:00 P.M. Council Dinner and Meeting.
8:30 P.M. Informal reception and dance, Curtis Hotel Ballroom.

Wednesday, June 25

10:30 A.M. Ladies' Shopping Tour.
2:00 P.M. Golf Tournament, Minneapolis Automobile Club (Research Cup).
Ladies' Golf Match, Automobile Club.
Bridge and Tea for ladies, Automobile Club.
7:00 P.M. Informal Dinner for members and ladies.

Thursday, June 26

1:30 P.M. Garden Party for ladies.
2:00 P.M. Golf Meet (Kicker's Handicap), Thorp Country Club.
7:00 P.M. Semi-annual banquet and dance, Hotel Curtis Ballroom.

Friday, June 27

12:30 P.M. Hostess luncheon for ladies.

A. S. H. V. E. Pioneer Limited

As announced last month in these columns, a feature of the trip to the summer meeting of the American Society of Heating and Ventilating Engineers, in Minneapolis, Minn., June 24-27, will be the special train for the benefit of members in and east of Chicago, leaving Chicago, June 23, at 6:30 P. M. (Central Standard Time) on the Chicago, Milwaukee, St. Paul and Pacific Railroad, arriving in Minneapolis the next morning. It will be known as the A.S.H.V.E. Pioneer Limited.

All members and guests who go by way of Chicago are invited to make the La Salle Hotel their headquarters, where a reception committee will greet them and will see that their baggage is transferred to the A.S.H.V.E. Pioneer Limited.

Association for Correlating Thermal Research

Under the chairmanship of Joseph C. Fitts, the Association for Correlating Thermal Research will hold its annual meeting in New York, June 19, at the New Yorker Hotel, during the convention of the Heating and Piping Contractors National Association.

Among the speakers will be Russell G. Creviston, of the Crane Company, Chicago, formerly manager of the Plumbing and Heating Industries Bureau. Mr. Creviston will speak on "The Commercial Value of Coordinated Research to the Heating Industry."

Organized in 1928 to encourage cooperation and research in thermal engineering with special reference to heating and ventilating, the association

already has made available a large amount of publicity data on this subject. Among the national organizations supporting the association are the A.S.H.V.E., H. & P.C.N.A., American Gas Association, and the National Warm-Air Heating Association.

Under the direction of Mrs. M. L. Houghten, technical librarian, three complete card catalogs are being developed covering existing data and research in thermal engineering. There also is being developed a cross-index card catalog of books, periodicals, magazine articles and pamphlets on the subject. 13,000 cards for 4,000 pieces of literature have been prepared, making the index the most complete of its kind.

Among its other activities, the association publishes a yearly directory of university laboratories, private laboratories, government bureaus, technical societies and trade associations engaged in or supporting research work in the thermal engineering field. The 1930 directory also contains an index of subjects under investigation in the 82 organizations listed.

Bibliographies have been prepared on such subjects as pipe welding, fuel economy and comparative study of all kinds of fuel, water heating, radiators and radiator testing.

Headquarters of the association are at the A.S.H.V.E. Research Laboratory, 4800 Forbes St., Pittsburgh, Pa.

Western Chapter Holds "Kentucky Night"

Dean F. Paul Anderson of the College of Engineering, University of Kentucky, and his University of Kentucky senior engineers were guests of the Western New York Chapter at its May meeting, held May 12 at the Hotel Statler, Buffalo, N. Y. Fully 150 members and guests were in attendance. Fletcher H. Burke, president of the chapter, acted as toastmaster.

Representing the University of Kentucky, in addition to Dean Anderson, was W. E. Freeman, assistant dean, College of Engineering; L. S. O'Bannon, professor of steam engineering; and J. B. Dicker, superintendent of shops, head of the Department of Practical Mechanics.

George F. Fiske, commissioner of public works, welcomed the visitors on behalf of the Mayor of Buffalo. Others present were President L. A. Harding, Treasurer Cecil W. Farrar, and Roswell Farnham, member of the council, of the A.S.H.V.E.

J. W. Pennel responded for the Kentucky engineers. He was followed by the speaker of the evening, Samuel B. Botsford, executive vice-president of the Buffalo Chamber of Commerce.

It was announced that the June meeting would take the form of an annual summer dinner dance at the Automobile Club in Clarence, N. Y.

At the April meeting of the chapter, Prof. John H. Curtin of D'Youville College, spoke on "The sun, the big furnace of little earth, or the source of all energy." His talk was illustrated with slides, most of which he had photographed himself in his observatory at High Point, N. Y.

New Officers of the Michigan Chapter

New officers of the Michigan Chapter, elected at the chapter's annual outing, May 14, at the Hawthorne Valley Golf Club, Detroit, are: President, E. E. Dubry; vice-president, R. K. Milward; secretary, E. H. Clark; treasurer, W. J. Whelan. Board of governors, George H. Giguere, L. L. McConachie and N. B. Hubbard.

Wisconsin Chapter Hears Talk on History of Ventilating

J. F. Sprague, of the Sprague Engineering Company, addressed the Wisconsin Chapter at the monthly meeting, held April 21. His subject was "Discussion of Different Types of Heating and Ventilating Systems Over a Period of Fifty Years." Mr. Sprague outlined the history of fans and fan blast heating systems, and told of the introduction of air washers in 1893. Although heating engineers in those days had no data with which to work, all jobs usually were supplied with plenty of heat. Mr. Sprague stated that the introduction of the vacuum system and temperature regulation were among the greatest achievements in the heating and ventilating field.

Several weeks prior to the meeting, questionnaires were sent to each member of the chapter, asking them to write three questions relating to the heating and ventilating field. These questionnaires were returned to the president, who in turn sent them out to those members best qualified to answer the questions. These were answered at the April meeting.

Some of the questions with their answers were as follows: "What purpose does a check valve serve in the return of a one-pipe steam job?" Answer: To prevent water backing out of the boiler due to leak in the piping, or too great a pressure drop to the main.

"How are boiler headers for steam built, and what is the proper pressure drop to figure in a vapor system?" Answer: Run the pipe up from the boiler into a horizontal nipple, gate valve, and then a drop into the main header. A good bleeder pipe is essential.

"What form of humidostat has proven most successful in general building ventilation?" Answer: No humidostat is absolutely satisfactory, although two types of instruments, one using hair and the other a fibrous material, are extensively used.

New York Chapter's Annual Jamboree

A successful season of the New York Chapter ended in a blaze of glory (if you get what we mean) at the Building Trades Employers Club, New York, May 12. The affair was in charge of Alfred Engel, of Jenkins Bros., and was witnessed, countenanced, enjoyed, and participated in, as you will, by some 165 members of the chapter and their friends.

Coal Conference at Chicago Maps Activities

Thirty-seven persons interested in promoting the use of coal and coal-heating equipment attended an all-day conference held at the Union League Club, Chicago, May 8. The meeting was for the purpose of laying a foundation for a practical program of coordinated activities between those interested in coal-heating equipment and coal producers, with a view to advancing a modern program of merchandising automatic heat.

It was agreed that contact between the various interests was practical, desirable and necessary. Each association represented will be asked to nominate members to a contact committee. It is proposed to prepare a manual for heating plant installations and for the servicing of complaints. Standard specifications for the installation of heating equipment will probably be drawn up.

Development of a definite point of contact through which the National Coal Association will be kept posted on new developments in coal-burning and coal-handling equipment was recommended. This was considered helpful in that it would provide information to the industry so that weight could be placed behind such substantial activities.

Organizations represented at the conference included: National Coal Association, Anthracite Institute, American Wholesale Coal Association, National Retail Coal Merchants' Association, National Warm Air Heating Association, Institute of Boiler and Radiator Manufacturers, Heating and Piping Contractors National Association, Stoker Manufacturers' Association and Midwest Stoker Association.

Correspondence

Latent Heat of Water in Air

EDITOR HEATING AND VENTILATING:

In a recent article by W. H. Carrier in HEATING AND VENTILATING the author stated that under humid conditions the latent heat given up by condensation of water vapor would be a considerable item. Can you inform me what is the value of this latent heat, say at 80°, when the relative humidity is 75%.

I know that the latent heat of steam at 212° is 970 B.T.U. per lb.

Sydney, Australia. W. H.

The latent heat of moisture in air is exactly the same as that given in the steam tables. Referring to these tables we find the values run as follows:

Dry Bulb Temp.	Heat of Vaporization, B.T.U. lb.
50	1062.3
59	1057.6
68	1052.8
77	1048.1
86	1043.3
95	1038.5

Saturated air at 80° contains 0.02226 lbs. of water per lb. of dry air. At 75% relative humidity the weight would be (0.75 x 0.02226) or 0.0167 lbs. Multiplying 0.0167 lbs. by the latent heat at 80° (1046) we obtain 17.50 B.T.U. per lb. of dry air as the latent heat. At the same temperature and relative humidity the total heat is 36.70 B.T.U. per lb. of dry air.

Single Chimney, Not Multiple Chimneys, Advisable

EDITOR HEATING AND VENTILATING:

In HEATING AND VENTILATING for May, under the heading of correspondence, I notice an article on Multiple Low Chimneys vs. Single High Chimneys, and I feel compelled to take issue with O.H.S. in this matter.

Most any one who has made a careful study of chimneys realizes that even with a battery of chimneys constructed side by side there will be a variation in the draft which is quite noticeable, and while the breeching from the boiler may be split up into branches to conform to the area of each chimney, the tendency of one of the group of chimneys will be to start off ahead of the others and the down draft will affect one or more of the group.

The writer was called in last fall to look over a condition duplicating the one suggested in the article and found that there was a decided down draft in one of the flues which so affected the remaining flues that it was impossible to secure any results in the boiler. In this case quite a number of changes were made with the idea of overcoming this tendency but without solving the problem.

In a number of cases I have seen attempts made to utilize the combined area of two or more chimneys of the same size and height but in no case have I found them successful in the attempt.

It is much better to have a single flue of an area slightly below the recognized proportion than to attempt to connect to two or more flues from the one apparatus.

In some cases you will find that the heating boiler is connected to a flue with sufficient area and that a small hot water heater for heating domestic water is connected into the same flue; this should be avoided as much as possible as it usually causes trouble during the summer months as there is not sufficient heat given off from the small heater to overcome the tendency of the heated outside air to pass down the flue into the cool basement. In a case of this kind a separate flue should be built alongside of the large flue in order to take care of the smaller heater.

As an engineer, I find that we cannot be too careful in the construction of flues and that it is important for the engineer to go over the matter with the architect prior to the erection of the chimney.

It is also highly important that the building of a group of chimneys be carefully supervised and it might be profitable to relate one experience that was brought to the writer's attention very forcibly.

In a fine residence recently erected the chimney was constructed having three separate flues, each being furnished with flue lining, one to take care of the heating apparatus, one for the domestic water heater and one for the open fireplace in the living room. When the heating apparatus was fired it was not possible to obtain the full efficiency from the boiler and the representative of the boiler manufacturer was called in. He looked into the size of the flues and the method of connecting without being able to solve the difficulty. After several weeks of firing, another engineer was called in and he immediately applied the smoke test with the result that, with the smoke test applied to the heating flue, smoke came out through the open fireplace and also through the connection from the small heater. The matter was referred back to the architect who ordered the masonry contractor to uncover the flue linings. It developed that the masons had neglected to fill in between the flue linings and the exposed brick work so that all the joints were open between the tile and the efficiency of all of the flues impaired.

It is needless to say that the entire chimney had to be rebuilt at the expense of the general contractor, after which no trouble was experienced.

Reading, Pa. A. W. L.

Professional Engineers' Licensing Law

EDITOR HEATING AND VENTILATING:

Some time ago a question was raised as to whether it is compulsory under the Professional Engineers' Licensing Law for all mechanical plans of schools, for heating, ventilating, sanitary and electrical systems to be designed and supervised by a professional engineer. The matter was put up to the University of the State of New York and the university, in its reply, forwarded a copy of the law covering the granting of certificates to professional engineers, and went on to say: "There has been no decision of the courts concerning the question you raise. The department has not ruled that all plans for heating, ventilating and sanitary systems must be designed and supervised by a professional engineer." It would appear from this that after qualifying and obtaining a license it is not necessarily compulsory under the state laws for the work of the state to be performed by licensed professional engineers. Can you enlighten me on the matter?

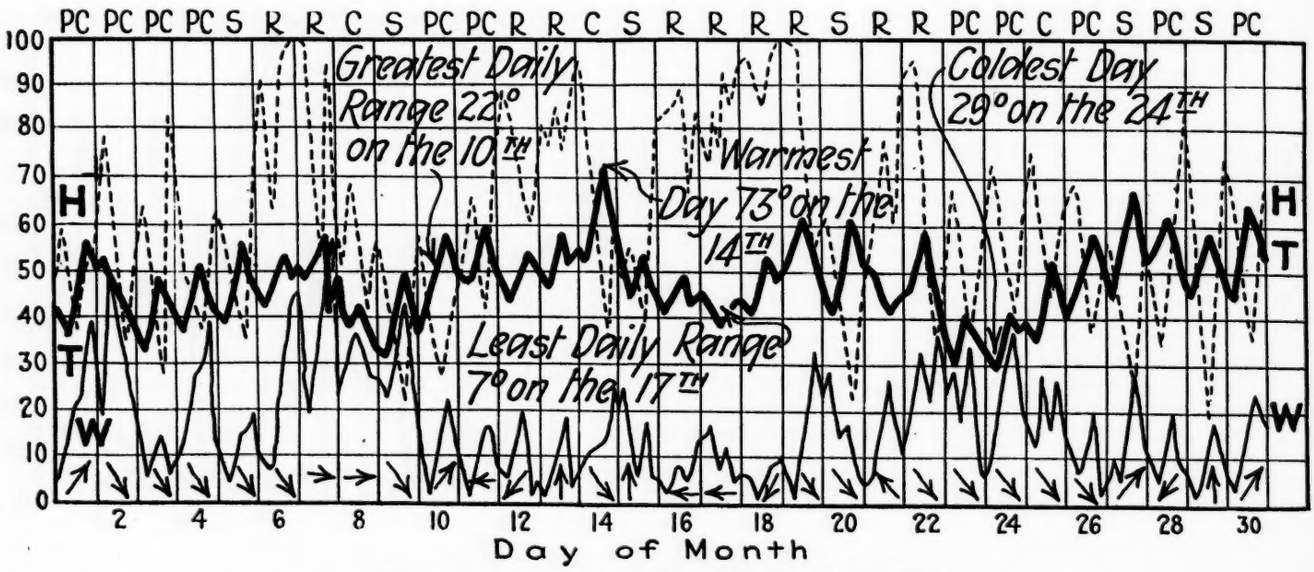
New York, N. Y. C. A.

The question raised by our correspondent was referred to D. B. Steinman, president of the New York Society of Professional Engineers and Land Surveyors, whose headquarters are in the Grand Central Terminal, New York. Mr. Steinman states:

"Your question in regard to the application of the Professional Engineers' Licensing Law is one of deep interest to me. As the law now stands, it does specifically require that all mechanical plans of schools, for heating, ventilation, sanitary and electrical systems must be designed and supervised by a professional engineer. A conflict arises from the provisions of the Architects' Registration Law requiring all plans for buildings to be designed and filed by architects. As a matter of practical interpretation, it is generally acknowledged that all such plans may be made and filed by either a licensed professional engineer or a registered architect, and that no such plans may be made and filed by any one who does not belong to either of these licensed classifications."

The Weather for April, 1930

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F	73	78	86	90	93
Date of highest temperature	14	14	11	11	10
Lowest temperature, deg. F	29	29	36	32	39
Date of lowest temperature	24	24	24	2	1
Greatest daily range, deg. F	22	31	36	43	39
Date of greatest daily range	10	10	5	11	10
Least daily range, deg. F	7	7	7	7	10
Date of least daily range	17	9	16	24	2
Mean temperature for month, deg. F	47.6	47.6	51.5	49.2	61.2
Normal mean temperature for month, deg. F	49.4	46.4	51.2	46.9	56.1
Total precipitation, this month, inches	2.01	2.09	2.60	2.30	1.32
Total snowfall, this month, inches	Trace	Trace	1.0	Trace	0
Normal precipitation, this month, inches	3.23	3 34	2.92	2.78	3.81
Total wind movement, this month, miles	10753	6195	7086	7043	7939
Average hourly wind velocity, miles	14.9	8.6	9.8	9.8	11.0
Prevailing direction of wind	N.W.	N.W.	N.W.	N.E.	S.
Number of clear days	6	11	9	11	12
Number of partly cloudy days	12	13	6	8	14
Number of cloudy days	12	6	15	11	4
Number of days with precipitation	11	6	13	10	6
Number of days with snowfall	0	0	3	0	0
Snow on ground, at end of month	None	None	None	None	None


PC PC PC PC S R R C S PC PC R R C S R R R R S R R PC PC C PC S PC S PC
Greatest Daily Range 22° on the 10TH
Warmest Day 73° on the 14TH
Coldest Day 29° on the 24TH
Least Daily Range 7° on the 17TH
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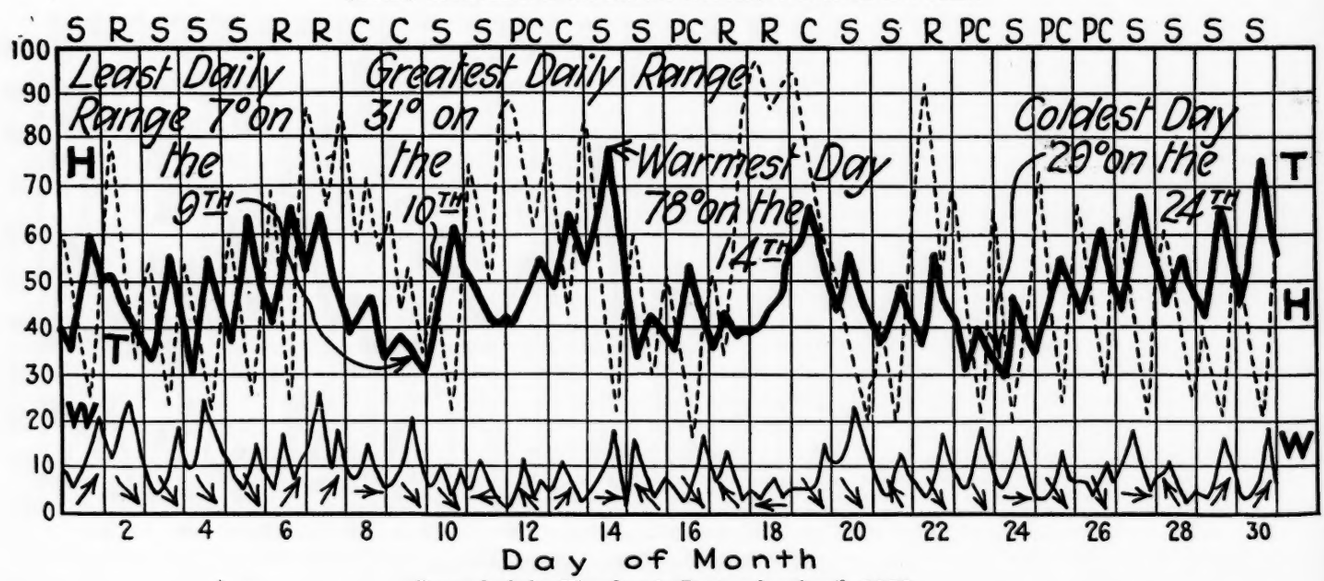
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Record of the Weather in New York for April, 1930
(Hourly Observation of the Relative Humidity Plotted on this Chart)


S R S S S R R C C S S PC C S S PC R R C S S R PC S PC PC S S S S
Least Daily Range 7° on the 9TH
Greatest Daily Range 31° on the 10TH
Warmest Day 78° on the 14TH
Coldest Day 29° on the 24TH
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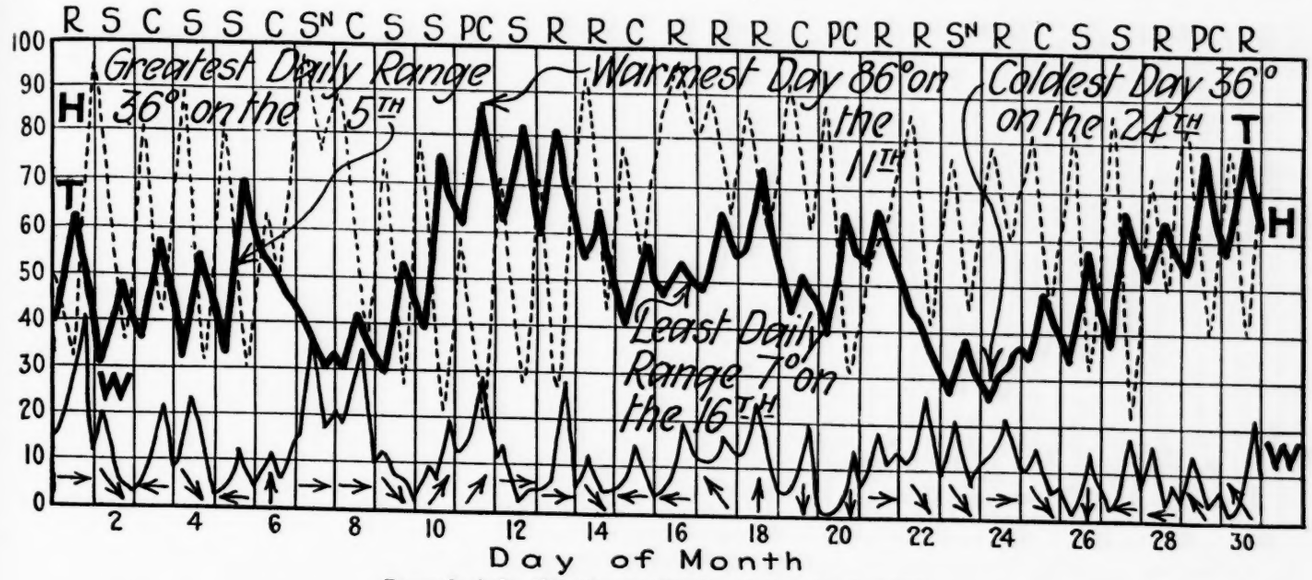
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Record of the Weather in Boston for April, 1930


R S C S S C SN C S S PC S R R C R R R C PC R R SN R C S S R PC R
Greatest Daily Range 36° on the 5TH
Warmest Day 86° on the 11TH
Coldest Day 36° on the 24TH
Least Daily Range 7° on the 16TH
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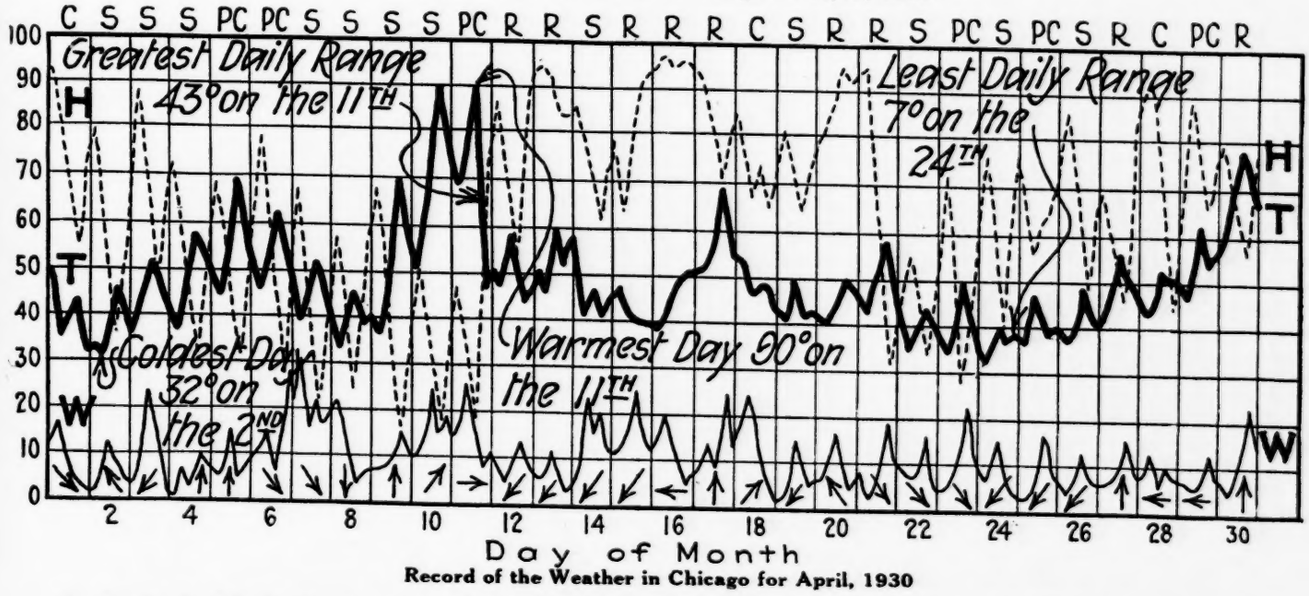
Day of Month

Record of the Weather in Pittsburgh for April, 1930


C S S S PC PC S S S S PC R R S R R R C S R R S PC S PC S R C PC R
Greatest Daily Range 43° on the 11TH
Least Daily Range 7° on the 24TH
Coldest Day 32° on the 2ND
Warmest Day 90° on the 11TH
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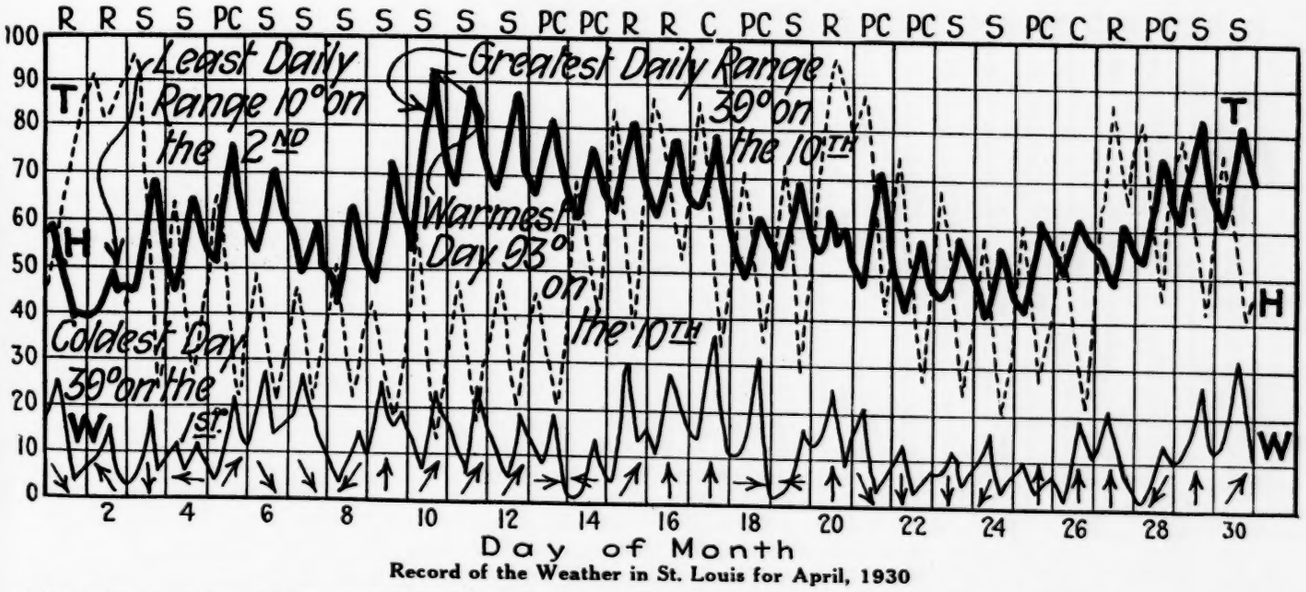
Day of Month

Record of the Weather in Chicago for April, 1930


R R S S PC S S S S S S S PC PC R R C PC S R PC PC S S PC C R PC S S
Least Daily Range 10° on the 2ND
Greatest Daily Range 39° on the 10TH
Warmest Day 93° on the 10TH
Coldest Day 39° on the 1ST
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Day of Month

Record of the Weather in St. Louis for April, 1930

Plotted from records especially compiled for HEATING AND VENTILATING by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A.M., 12 M., and 8 P.M. Arrows fly with prevailing directions of wind.
S—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.

Degree-Days and Unit Fuel Consumption in Typical Cities for April

UNIT fuel consumption figures given below must be corrected for efficiency, heat content of fuel other than that listed below, for radiation emitting other than 240 B.T.U. per hr., and for radiation calculated on a basis of other than zero to 70°.

Coal is assumed as having a heat content of 12,000 B.T.U. per lb., gas, 1000 B.T.U. per cu. ft., and oil 140,000 B.T.U. per gal. To correct for other heating values, multiply the fuel consumption listed under the charts by the standard heat content just listed, and divide by the heat content in question.

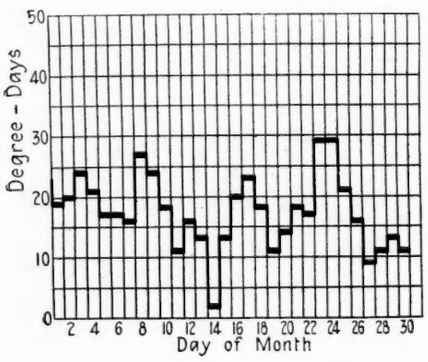
To correct for efficiency, divide the fuel consumption by the efficiency of the heating installation.

For water radiation, multiply the fuel consumption, which is given for steam radiation, by 5/8.

For radiation installed for any other outside temperatures than zero, multiply the fuel consumption given under the charts by 70°, divided by the quantity (70 minus the outside temperature used).

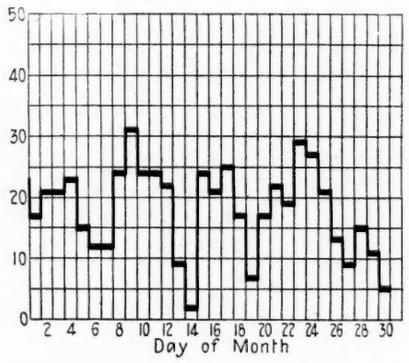
	Los Angeles	Baltimore	Philadelphia	New Orleans	Atlanta	Cleveland	Cincinnati	Detroit
Degree-Days	76	374	415	1	107	508	298	525
Lbs. of Coal per Sq. Ft. of Radiation for April, 1930	0.61	2.99	3.32	0	0.86	4.06	2.38	4.20
Gals. of Oil per Sq. Ft. of Radiation for April, 1930	0.052	0.256	0.285	0	0.074	0.349	0.204	0.360
Cu. Ft. of Gas per Sq. Ft. of Radiation for April, 1930	7.3	35.9	39.8	0	10.3	48.8	28.6	50.4

(See Footnote)



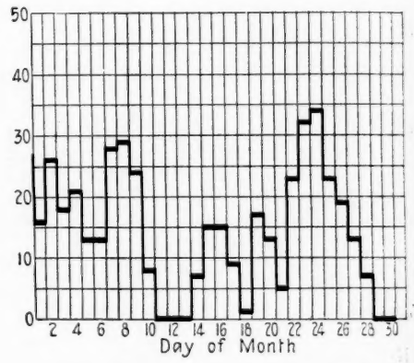
New York, April, 1930

Degree-Days 518—to Date, 4909
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 4.14
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.356
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 49.7
(See Footnote)



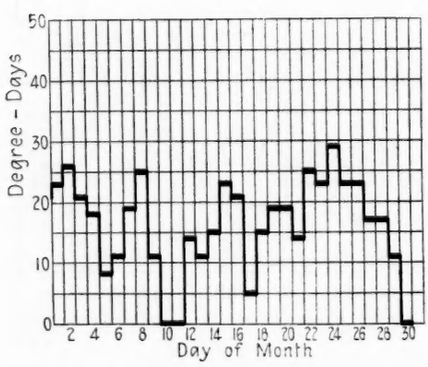
Boston, April, 1930

Degree-Days 524—to Date, 5340
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 4.19
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.369
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 50.4
(See Footnote)



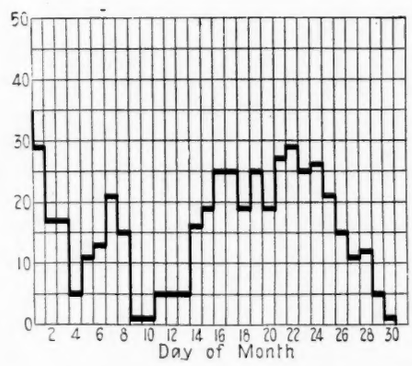
Pittsburgh, April, 1930

Degree-Days 429—to Date, 5177
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 3.43
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.294
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 41.1
(See Footnote)



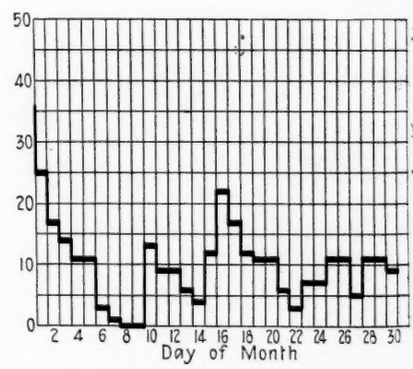
Chicago, April, 1930

Degree-Days 486—to Date, 6012
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 3.89
Gals. of Oil per Sq. Ft. of Radiation for this Month. 0.334
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 46.6
(See Footnote)



Minneapolis, April, 1930

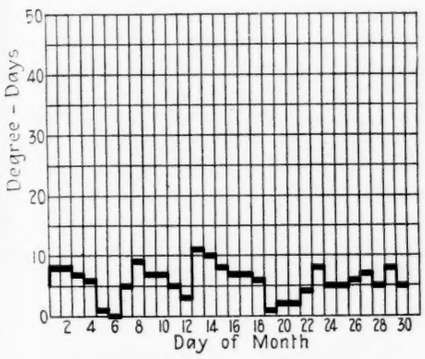
Degree-Days 465—to Date, 7610
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 3.72
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.319
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 44.6
(See Footnote)



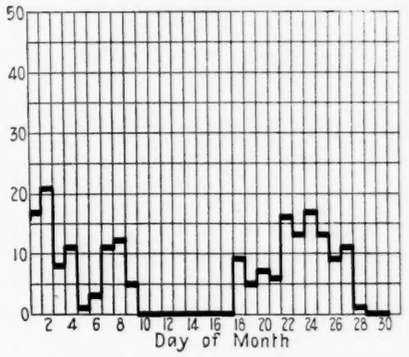
Denver, April, 1930

Degree-Days 289—to Date, 5813
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 2.31
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.198
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 27.8
(See Footnote)

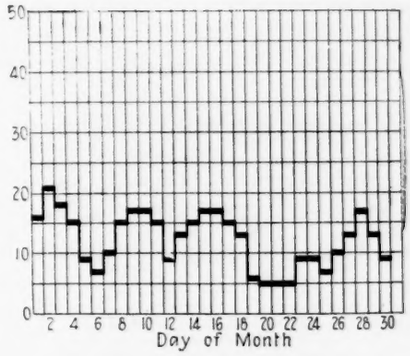
These figures must be corrected for local conditions as explained above.



San Francisco, April, 1930
Degree-Days 173—to Date, 1854
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 1.39
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.119
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 16.6
(See Footnote, Page 112)



St. Louis, April, 1930
Degree-Days 196—to Date, 4455
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 1.57
Gals. of Oil per Sq. Ft. of Radiation for this Month 0.135
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 18.8
(See Footnote, Page 112)



Seattle, April, 1930
Degree-Days 367—to Date, 4217
Lbs. of Coal per Sq. Ft. of Radiation for this Month, 2.94
Gals. of Oil per Sq. Ft. of Radiation for this Month, 0.252
Cu. Ft. of Gas per Sq. Ft. of Radiation for this Month, 35.2
(See Footnote, Page 112)

Exhibitors at Master Plumbers' Convention

Among the exhibitors who have taken space at the annual exhibit of plumbing, heating and allied products, to be held under the auspices of the National Association of Master Plumbers, in connection with its 48th annual convention in the Mechanics Building, Boston, Mass., June 23-26, inclusive, are:

American Radiator Co., New York.
Burnham Boiler Corp., Irvington, N. Y.
A. M. Byers Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
Crystal Oil Burner Corp., New York.
Dahlquist Mfg. Co., South Boston, Mass.
Everhot Heater Sales Co., Detroit, Mich.
Excelso Products Corp., Buffalo, N. Y.
Gar-Wood Engineering Co., Detroit, Mich.
Grinnell Co., Providence, R. I.
Jenkins Bros., New York.
Johns-Manville Corp., New York.
Kewanee Boiler Co., Inc., New York.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mueller Co., Decatur, Ill.
Nash Engineering Co., South Norwalk, Conn.
National Tube Co., Pittsburgh, Pa.
Nye Tool & Machine Works, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Perfect Ventilator Co., Malden, Mass.
Radiator Specialty Co., Charlotte, N. C.
Reading Iron Co., Boston, Mass.
Richardson & Boynton Co., New York.
H. B. Smith Co., Cambridge, Mass.
B. F. Sturtevant Co., Boston, Mass.
Toledo Pipe Threading Machine Co., Toledo, O.
Vinco Co., Inc., New York.
Walworth Co., Boston, Mass.
Weil-McLain Co., Chicago, Ill.
"X" Laboratories, New York.
Youngstown Sheet & Tube Co., Youngstown, O.
Waltham Oil Burner Corp., Waltham, Mass.

Address of welcome will be made by Governor Frank G. Allen of Massachusetts and Mayor James E. Curley of Boston.

During the convention there will be discussions of business getting methods for master plumbers who have up-to-date shops in the heart of the downtown section, those who conduct "shops on wheels" and those who confine themselves to the larger contract work. All of the convention and exhibition events will take place in the Mechanics Building, which will be open from 10:00 A.M. to 10:00 P.M., except on Thursday, when it will close at 6:00 P.M.

Moving Pictures of British Embassy Panel Heating

A score or more of prominent architects, engineers and builders were guests of Wolff and Munier, Inc., at the Building Trades Club, New York, May 19, to witness a motion picture of the panel heating installation in the new British Embassy buildings in Washington. A luncheon preceded the showing of the pictures.

The film was made by the Linde Air Products Company, of New York, as most of the piping in the system was welded by the oxyacetylene process.

During the presentation R. A. Wolff commented on the work as it was portrayed on the screen. At its conclusion he answered a battery of questions which indicated the keen interest in the panel heating method.

Among those present were: (Architects) Robert D. Kohn, Kohn & Butler; Carl Grieshaber, Delano and Aldrich; George Morse, McKim, Mead & White; Norman B. Baker, Hood, Godley & Fouilhoux; Robert O'Connor, Morris and O'Connor; Hobart Upjohn; Irvin J. Busch, Mott B. Schmidt; Harold R. Sleeper, Frederick L. Ackerman; Melville Nauheim, Harry Allan Jacob; Harry R. Dowswell, Shreve, Lamb & Harmon; (Consulting Engineers) Alfred L. Jaros, Jr. and Albert L. Baum, Jaros & Baum; John G. Eadie and J. K. Campbell, Eadie, Freund and Campbell; A. M. Feldman; Chester Hosmer, Syska & Hennessy; Frank Pattison, Pattison Bros.; Alfred J. Offner; (Builders) G. Richard Davis; John Lowry; Harold Ehni, C. T. Wills, Inc.

Government Building Estimates Eleven Billion

According to Julius Klein, assistant secretary of the Department of Commerce, government economists have increased their construction estimates for this year by another billion dollars, making the total $11,000,000,000.

This construction bill for 1930 represents public and private building and maintenance, including the activities of public utilities. The increase in the estimate is almost entirely in the field of commercial and industrial structures and other private operations.

Mr. Klein also estimates that federal expenditures for 1930, for building and ground improvements, will amount to between $60,000,000 and $70,000,000.

Addendum to Chrysler Equipment

In addition to the items in the list of equipment for the Chrysler Building published in connection with the article by Louis T. M. Ralston, in HEATING AND VENTILATING for May, expansion joints were also furnished by the Ross Heater and Manufacturing Co., Buffalo, N. Y. in addition to those listed furnished by the American District Steam Company.

Legal Decisions

Seller's Right to Radiators Sold on Conditional Sales Contract as Against Purchase of Realty

Clow Gasteam radiators were sold on conditional sales contract to the owner of a garage who, after two payments, defaulted on the contract and sold the property. The seller of the radiators asserted title to them, and threatened to enforce its claim by an action of replevin. A bill of complaint was filed by the purchaser of the property in the circuit court of Baltimore City against the seller of the radiators, praying that it be enjoined (1) from removing "said heating plant" from the property, and (2) from instituting and prosecuting any action at law which might result in its removal. A writ of replevin obtained by the seller prevented the seizure of the radiators, but prosecution of that proceeding was restrained pending the action of the purchaser of the property. The injunction was dissolved and the bill dismissed. The purchaser appealed.

It appeared from the pleadings and the evidence that the radiators weighed about 600 lbs. each, and rested upon brackets screwed to the walls of the building; they were all connected with a single gas supply pipe, but, aside from that, appeared to be independent units, as the water for the generation of steam was supplied separately to each radiator through a filling cap on the side. The whole system was installed by its seller, and could be removed without any material damage to the property. It was provided in the conditional sales agreement that the title to the radiators should remain with the seller until the whole of the purchase price should be paid, and that on default in payment the seller might repossess them. The contract was duly recorded. When the plaintiff bought the property he had no knowledge of the existence or recording of the contract. It did not appear whether the radiators were essential to the ordinary and convenient use of the property.

The appeal submitted these questions:

(1) Does a conditional sales contract duly recorded under Maryland Code, Article 21, Section 55, afford the purchaser of real property constructive notice that the title to the articles described therein, which at the time the contract was made were chattels, but which, when the real estate was purchased were so incorporated therewith as to become an integral part thereof, is reserved to the conditional vendor (a) when the character of the chattels is such that the vendor must have known that they would in ordinary course be so used and converted; (b) where they were not of that character?

This proposition is novel to the Maryland courts and the decisions in other jurisdictions are too conflicting to establish any rule which can be said to be generally accepted. Some courts have taken the view that the recording of a chattel mortgage or a conditional sales contract, under a statute making such recordation constructive notice to third persons, is sufficient to charge a bona fide purchaser for value of real estate to which chattels are annexed with notice of any lien or title reserved in such mortgage or conditional sales contract to or against such chattels. The Illinois, Kansas, New Jersey, New York and Virginia Supreme Courts have so held. But the Illinois, Kansas and New York cases limit the application of the rule to cases where the chattels are of such a character that they may be removed without damage to the freehold, and where their essential utility does not require that they should be so annexed to the freehold as to become a part thereof. So that they are consistent with the theory that, where the nature of the chattels is such that, if used for the purpose for which they were made, they would naturally and necessarily be annexed to and become a part of some freehold, such recording would not be constructive notice to the purchaser of such real estate.

Other courts which have taken the opposite view are those of California, New Hampshire, Ohio and Texas. The Maryland Supreme Court, adopting the view of these latter, construes the Maryland statute, which provides that such conditional sales contracts shall be void as to third parties without notice until recorded and that "such recording shall be sufficient to give actual or constructive notice to third persons" when a memorandum thereof shall be recorded, to mean that it shall be sufficient to give such notice so long as the goods or chattels described in the memorandum remain chattels, but not to mean that it shall be sufficient to give such notice where they have with the consent or assent of the conditional sales vendor become integrated with real property.

Where the conditional sales vendor participates in or consents to such integration, therefore, he will not be heard, as against an innocent purchaser of the realty, to say that the goods or chattels are not part of the realty.

And the recording of a conditional sales agreement under the Maryland statute, reserving titles to the vendor in goods and chattels which have become incorporated with the real property, is not constructive notice to a bona fide purchaser of such property, who purchased after the annexation, where the vendor knew, or was in reason bound to anticipate, that such annexation would take place. But it would afford such notice where the nature of the goods and chattels was such that the vendor was not reasonably bound to anticipate that they would be so annexed, and where he did not consent to such annexation.

(2) The second question was: Were the radiators at the time the purchaser of the real estate took title thereto, so annexed to the realty as to become a permanent and integral part thereof?

The uncontradicted evidence was that both the radiators and the pipes could readily and quickly be removed without any damage to the property, that each radiator in itself constituted an independent heating unit, and that they had no connection with each other, except that gas was supplied to all of them by the same supply pipe. Such evidence was held to be wholly inconsistent with the theory that the radiators were a part of the freehold, unless that inference was to be drawn from the fact that they were placed in the building for the purpose of heating it.

"The radiators so far as the record shows, were ten separate heating appliances, having no more connection with the freehold than an ordinary gas heater, portable kitchen range, or heating stove, which are certainly, by the weight of authority, held not to be fixtures. Ewell on Fixtures, p. 300. Such cases as Keeler v. Keeler, 31 N. J. Eq. 181, are not in point, for, while the pipes to which the court referred in that case were readily removable without damage to the freehold, they constituted a necessary part of a heating plant, which itself was a part of the freehold; but more in point are the cases of Rahway Sav. Inst. v. Irving St. Baptist Church, 36 N. J. Eq. 61, National Bank v. North, 160 Pa. 303, and Mote Iron Works v. Middle States Co., 17 App. D. C. 584."

Since the radiators retained their character as personal property and were described in the conditional sales contract which was duly recorded, such recording was held sufficient to charge the purchaser of the realty with notice of the fact that the conditional sales vendor retained title to them. The parties to the conditional sales contract had the right to agree that the radiators should retain their character as personal property, and could be retained by the vendor in the event of a default under the agreement. The decree dissolving the injunction and dismissing the bill was therefore affirmed. Abramson v. W. W. Penn & Co. Maryland Court of Appeals, 143 Atl. 195.

California Law to Conserve Gas Held to Be Valid

The constitutionality of the California natural gas conservation act, which became effective in September, 1929, was upheld in an opinion handed down in Los Angeles, March 12, by Judge William Hazlett in the State Superior Court, according to *The United States Daily*, for March 14.

Immediately following this ruling, Judge Hazlett began hearing testimony on a petition of the State Director of Natural Resources, Fred G. Steyenot, to enjoin independent oil operators in the Santa Fe Springs district from wasting gas.

The hearing will determine whether a temporary restraining order will be issued against the defendants.

The law is attacked by independent operators on the ground that it is an infringement upon the rights of ownership of private property guaranteed by the Constitution.

Judge Hazlett summarized his conclusions in the opinion as follows:

"I am finally satisfied that the great natural resources not made by the hand of man should be and can be conserved by legislation and their taking and use limited for the general public good and for the good of those owning or producing. These general principles are established by our courts.

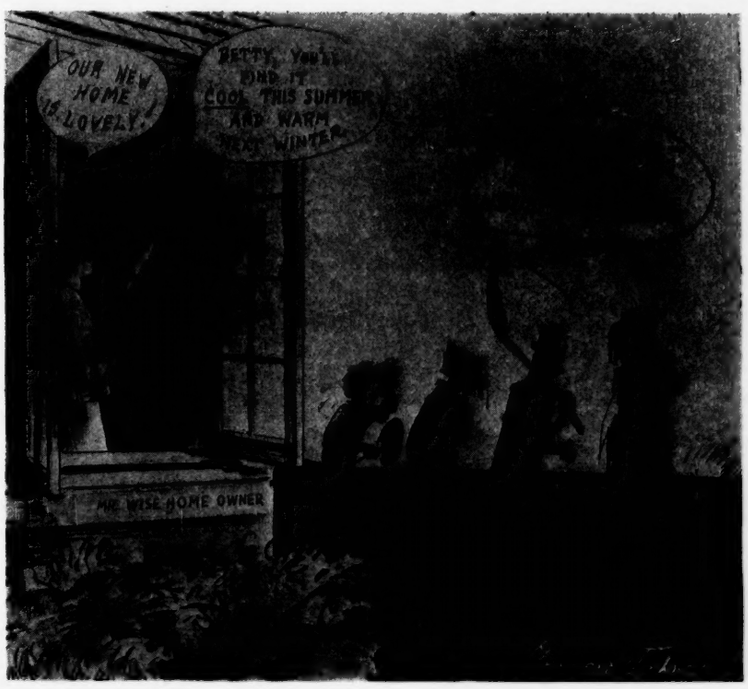
"It appearing that there is a great and unreasonable waste of gas in the Santa Fe Springs oil field, it is my purpose to assume, if the evidence in regard to it is supplemented by sufficient other proof so that no great harm may be done to any single operator, to issue a temporary restraining order putting a stop, at least in part, to the tremendous waste, and upon taking all of the proof that may be offered, to make such modification of the temporary order as may seem proper.

"If the proof shall be such as to show that I can equitably grant a temporary injunction which will conserve gas at least in part, I shall do so with the least delay."

Oil-Burner Rules Changed

At the 34th annual meeting of the National Fire Protection Association Convention, held in Atlantic City, May 12-15, the Inflammable Liquids Committee recommended that the requirements for screens in vent caps in oil-burner

Effective Use of Cartoons to Drive Home the Value of Building Insulation



installations be omitted. Minimum vent pipe sizes were increased from 1 in. to 1¼ in. diameter, and the minimum wall thickness of copper tubing was changed to 0.049 in. from 1/16 in. The latter rule makes possible the use of commercial tubing for such installation. All the changes recommended were adopted by the association.

Chicago Oil Burner Association Meets

The regular monthly dinner meeting of the Chicago Oil Burner Association was held on Tuesday, May 20. Forty-seven members and guests were in attendance.

Miss Ann McLoughlin, who had been acting as temporary secretary-treasurer since that office was vacated last July by Cliff W. Presdee, was elected to honorary membership in the association. Hamlin Petty was unanimously elected secretary-treasurer.

J. Heber Hudson of the Illinois Chamber of Commerce was the guest speaker of the evening.

Applications of Hamlin Petty and C. M. Wilkins to associate membership and affiliate membership, respectively, were unanimously accepted.

Forty-five members and guests attended the regular monthly meeting of the Chicago Oil Burner Association, April 21. Homer J. Buckley, president of the Buckley-Dement Company, Chicago, was the guest speaker of the evening, and spoke on "Salesmanship."

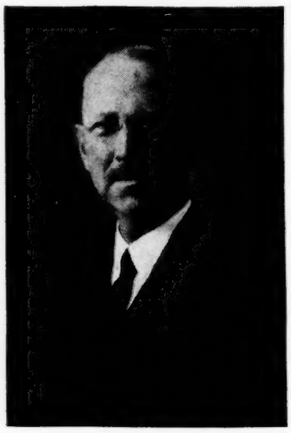
At a meeting held April 25, the following were appointed to serve as chairmen of the 1930 standing committees: Entertainment, H. E. Risher; membership, J. W. Owens; members complaint, I. M. Nelson; fire investigation, F. C. Staples; cooperation, T. N. Andrew; program, H. C. Bitter.

An invitation by the American Radiator Company to each active member of the association to place a burner on display in the company's showroom for a week at a time was enthusiastically and unanimously accepted.

March Shipments of Oil Burners

March shipments of oil burners, as reported by fifty manufacturers whose output constituted 60% of the total for the industry in 1927, amounted to 3346 as compared with 2954 in February, and 4137 in March of last year.

Of these burners, 2322 were mechanical draft domestic burners and 583 natural draft domestic burners, the remainder being industrial burners.



William Gage Snow

Death of William Gage Snow

William Gage Snow, president and treasurer of the Middlesex Products Company, died of heart failure at his home, 11 Devon Road, Newton, Mass., February 14. Mr. Snow was born in 1866. After graduating from Massachusetts Institute of Technology in 1888, Mr. Snow went to Philadelphia and devoted his time to the heating industry, later returning to Boston to become the New England manager of Warren Webster & Company, a position he held for several years. In April, 1918, he left the heating business to join the Middlesex Products Company, manufacturers of fancy paper, as its treasurer. Upon the death of his brother, Walter B. Snow, he became president of the company in addition to being treasurer, holding both positions until his death.

In 1903, Mr. Snow joined the American Society of Heating and Ventilating Engineers, and in 1909, became president. In addition to contributing many papers to the society, Mr. Snow was the author of "The Principles of Heating" and "Furnace Heating." Although he resigned from the society in 1922, Mr. Snow maintained an active interest in its affairs.

James V. Scaife

James V. Scaife, president of William B. Scaife & Sons Co., Pittsburgh, Pa., died recently in his sixty-second year, at the St. Francis Hospital. Mr. Scaife was a graduate of Cornell University.

F. H. Gaylord

F. H. Gaylord, president of Hoy & Co., Inc., Albany, N. Y., died of heart disease at the Albany Hospital, April 16, at the age of 55. Mr. Gaylord was well known throughout the industry, beginning his career with Hoy & Company thirty years ago. He was active in civic and fraternal affairs, having been a member of the Albany Rotary Club, and a former master of the Ancient City Lodge.

Oil Burners Approved Since February, 1930

In HEATING AND VENTILATING for December, 1929, and January, March, and April, 1930, a list of domestic oil burners inspected by the Underwriters' Laboratories was published, including those burners approved up to February 14, 1930. The list appearing on page 117 includes domestic burners inspected and passed since February 14, up to and including April 8.

Oil fuel specifications referred to are those accepted as standard by the burner manufacturers, oil producers and refiners, following the standardization project proposed by the Department of Commerce, and adopted last summer as standard by the industry.

All burners listed are mechanical draft burners except where the notation "natural draft" occurs in the column under the heading "Motor Drive."

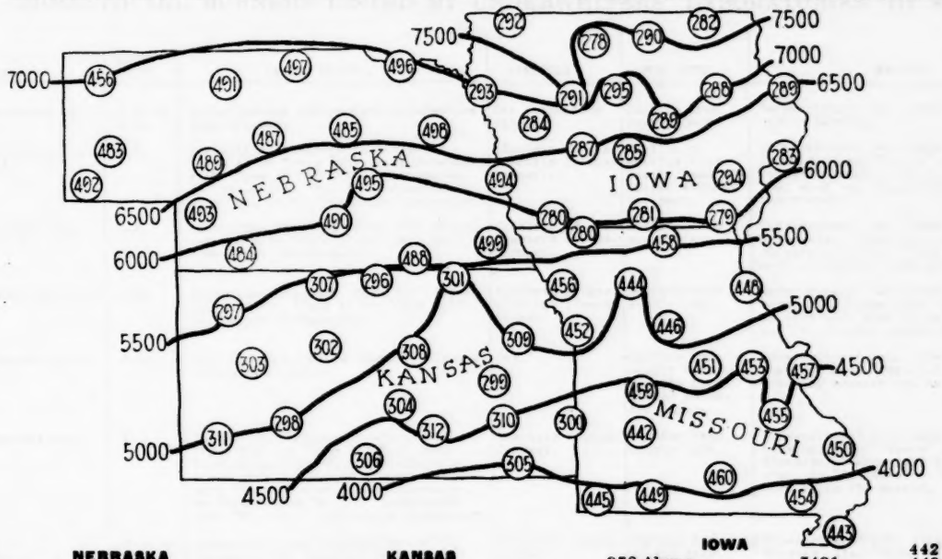
Midwest Stoker Association Elects Officers

At a meeting held at the Medinah Athletic Club, May 5, the Midwest Stoker Association was formally organized, and the following officers and directors chosen: President, E. L. Beckwith, Detroit Stoker Company; vice-president, R. C. Goddard, Combustioneer, Inc.; secretary-treasurer, W. N. Edwards, The Brownell Company; director, A. O. Dady, Delta Company; director, C. E. Beery, Economy Stoker Company.

Regular monthly meetings will be held. The association is now working to establish engineering standards governing the installation of stoker equipment, and is taking steps to cooperate with kindred associations, such as the National Coal Association, Illinois and Indiana Coal Operators Association, Stoker Manfacturers Association and other allied organizations.

The objects of the association are to inculcate a spirit of cooperation among its members and allied industries, and to establish ethical standards, sound engineering principles and local commercial practices.

Charter members of the association are: Auburn Stoker Corporation, Brownell Company, Combustioneer, Inc., Delta Company, Detroit Stoker Company, Economy Stoker Company, Iron Fireman Corporation, Modern Coal Burner Company, Whiting Corporation.



No. 5-M New Series

ISO-DEGREE-DAY CHARTS—Nebraska, Kansas, Iowa and Missouri.

NEBRASKA

483 Bridgeport	6829
484 Culbertson	5607
485 Dumas	7203
486 Fort Robinson	7093
487 Halsey	6646
488 Hebron	5952
489 Hillside	6830
490 Kearney	6048
491 Kennedy	6921
492 Kimball	6721
493 Madrid	6454
494 Omaha	6128
495 St. Paul	5954
496 Santee	6864
497 Springview	6869
498 Stanton	6797
499 Tecumseh	5771

KANSAS

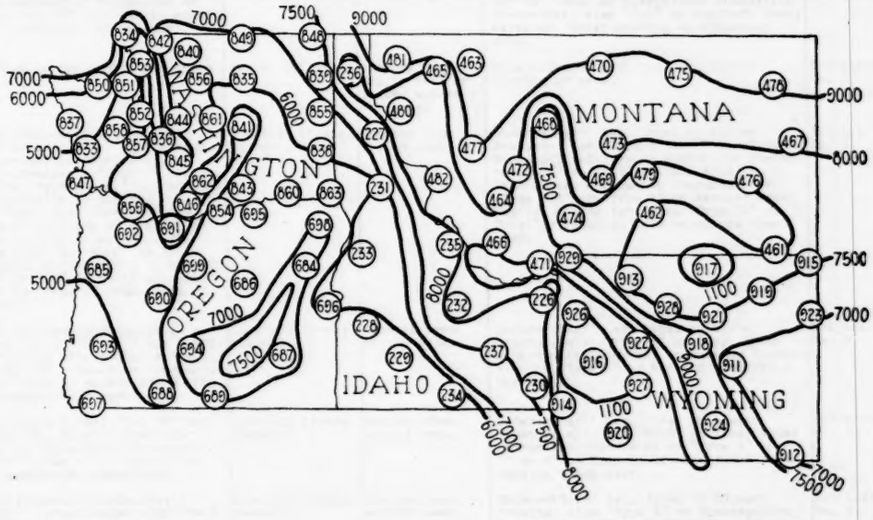
296 Burr Oak	5877
297 Colby	5638
298 Dodge City	5034
299 Emporia	4792
300 Fort Scott	4379
301 Hanover	3044
302 Hays	5268
303 Healy	5371
304 Hutchinson	4679
305 Independence	4024
306 Medicine Lodge	4238
307 Phillipsburg	5407
308 Salina	4969
309 Topeka	5301
310 Toronto	4581
311 Ulysses	5008
312 Wichita	4877

IOWA

278 Algona	7421
279 Bonaparte	6159
280 Clarinda	6285
281 Corydon	6262
282 Cresco	8517
283 Davenport	6287
284 Denison	6803
285 Des Moines	6373
286 Dubuque	6788
287 Guthrie Center	6573
288 Independence	7075
289 Marshalltown	7094
290 Mason City	7571
291 Rockwell City	8003
292 Sibley	7917
293 Sioux City	7023
294 Washington	6322
295 Webster City	6781

MISSOURI

442 Bolivar	4327
443 Caruthersville	3429
444 Chillicothe	4900
445 Dean	3942
446 Glasgow	5234
447 Grant City	5659
448 Hannibal	5245
449 Hollister	3750
450 Jackson	4229
451 Jefferson City	4874
452 Kansas City	5202
453 New Haven	4542
454 Poplar Bluff	3910
455 Potosi	5287
456 St. Joseph	5142
457 St. Louis	4585
458 Unionville	5930
459 Warsaw	4449
460 Willow Springs	4303



No. 5-L New Series

ISO-DEGREE-DAY CHARTS—Washington, Montana, Oregon, Idaho and Wyoming.

WASHINGTON.

833 Aberdeen	5518
834 Blaine	6120
835 Brewster	6392
836 Buckley	5573
837 Clearwater	5698
838 Colfax	6380
839 Cusick	7324
840 Davis Ranch	6342
841 Ephrata	4552
842 Glacier	7049
843 Kiona	4972
844 Lake Kachess	7690
845 Longmires Springs	7650
846 Lyle	5375
847 North Head	5452
848 Northport	7170
849 Oroville	6224
850 Port Angeles	6709
851 Port Townsend	5513
852 Seattle	4968
853 Sedro Woolley	5402
854 Sixprong	5083
855 Spokane	6353
856 Stehekin	6681
857 Tacoma	5180
858 Union City	5312
859 Vancouver	4748
860 Walla Walla	4809
861 Wenatchee	6658
862 Yakima	5690
863 Zindel	4311

MONTANA

461 Biddle	7783
462 Billings	7115
463 Browning	9396
464 Butte	8271
465 Columbia Falls	8077
466 Dillon	7794
467 Glendive	8236
468 Great Falls	7233
469 Harlowton	9377
470 Havre	8699
471 Hebgen Dam	10944
472 Helena	7932
473 Lewiston	8230
474 Livingston	7200
475 Malta	8912
476 Miles City	7719
477 Ovando	9145
478 Poplar	9241
479 Roundup	7492
480 Thompson Falls	7345
481 Upper Yaak River	9207
482 Victor	7636

OREGON

684 Baker	7166
685 Falls City	5367
686 Dayville	5510
687 Diamond	7307
688 Klamath Falls	6461
689 Lakeview	7094
690 McKenzie Bridge	5703
691 Parkdale	6555
692 Portland	4468
693 Roseburg	4627
694 Silver Lake	7423
695 Umatilla	4886
696 Vale	6264
697 Waldo	5645
698 Wallowa	7360
699 Warmspring	5687

IDAHO

226 Ashton	8087
227 Avery	6946
228 Boise	4558
229 Glenns Ferry	5683
230 Grace	7650
231 Kooskia	5939
232 Mackay	8579
233 New Meadows	8524
234 Oakley	6458
235 Salmon	7969
236 Sandpoint	7327
237 Springfield	7477

WYOMING

911 Casper	6979
912 Cheyenne	7462
913 Cody	7767
914 Cokeville	10519
915 Colony	7784
916 Daniel	11118
917 Dome Lake	11612
918 Ervay	8594
919 Gillette	7516
920 Green River	7199
921 Griggs	7519
922 Kinnear	8113
923 Newcastle	7428
924 Pathfinder	7398
925 Saratoga	8630
926 Snake River	10956
927 South Pass City	11110
928 Worland	8058
929 Yellowstone Park	9546

Heating and Ventilating's Data Sheets Nos. 5-L and 5-M

DOMESTIC OIL BURNERS LISTED BY UNDERWRITERS' LABORATORIES TO APRIL 8, 1930

MANUFACTURER	MOTOR DRIVE	SAFETY CONTROL	IGNITION	FUEL FEED	MARKING	FUEL
Arcoil Manufacturing Co., Newark, N. J.	A.C. or D.C.	Anti-flooding device (own manufacture trip switch).	Gas (expanding pilot).	Suction from supply tank.	Underwriters' Lab. label on main burner casting.	Not heavier than No. 3.
Bettendorf Oil Burner Co., Bettendorf, Ia.	A.C.	Combustion (Minneapolis-Honeywell "Type A" or "Type BPR" Protectorelay with "Type A" combustion thermostat, or Time-O-Stat "No. 77" Lockswitch with "No. 48-H" combustion thermostat)	Electric or gas-electric (transformer).	Suction or gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on blower housing; also "Type A" on Minneapolis-Honeywell combustion thermostat; or "No. 48-H" on Time-O-Stat combustion thermostat.	Not heavier than No. 3.
Braden Engineering Inc., Providence, R. I.	A.C.	Combustion (Mercoid "Type SDP" Adjustatherm with "Type L" or "Type M-1" combustion thermostat).	Electric or gas-electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on burner base; also "Type OB-3, OB-4, T or D-1" on strainer; also "Type L" or "Type M-1" on Mercoid combustion thermostat.	Not heavier than No. 3.
Burgess Oil Heating Corp., Utica, N. Y.	A.C.	Combustion (Mercoid "Type SDP" Adjustatherm with "Type L" or "Type M-1" combustion thermostat).	Electric or gas-electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on burner base; also "Type OB-3, OB-4, T or D-1" on strainer; also "Type L" or "Type M-1" on Mercoid combustion thermostat.	Not heavier than No. 3.
Crystal Oil Burner Corp., New York, N. Y.	A.C.	Anti-flooding device (Mercoid "Type A" safety drip switch).	Gas.	Suction from supply tank or gravity from listed automatic pump.	Underwriters' Lab. label on blower housing; also "Type L-1 or L-2" on cracking chamber and on fire pot.	Not heavier than No. 1.
Eisler Engineering Co., Inc., Newark, N. J.	A.C.	Combustion (Minneapolis-Honeywell "Type TIR" or "Type R-103-1" Protectoreley with "Type A" combustion thermostat or "Type DSS" motor switch with "Type B" combustion thermostat, or Time-O-Stat "No. 77" Lockswitch with "No. 48-C" combustion thermostat)	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing; also "Type A" or "Type B" on Minneapolis-Honeywell combustion thermostat, or "No. 48-C" on Time-O-Stat combustion thermostat.	Not heavier than No. 3.
Electrol Inc., St. Louis, Mo.	A.C. or D.C.	Combustion (own manufacture safety control, with Electrol combustion thermostat, or, with Minneapolis-Honeywell "Type A" combustion thermostat or Mercoid "Type M-1" combustion thermostat).	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing, also "Model T" or "Type OB" or "D-1" on strainer body; also "Model T" on rotary converter (D.C. burner); also "Type A" on Minneapolis-Honeywell or "Type M-1" on Mercoid combustion thermostat.	Not heavier than No. 3.
Fess Oil Burners of Canada, Ltd., Toronto, Ont., Can.	A.C.	Combustion (Time-O-Stat "No. 77" Lockswitch with "No. 48-H" combustion thermostat or Mercoid "Type SM" combustion thermostat).	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on burner housing; also "Type D-1" or "Type D-3A" on fire door assembly and strainer for burners "Type D-S, D-A, and D-3-A"; also "No. 48-H" on Time-O-Stat combustion thermostat or "Type SM" on Mercoid combustion thermostat.	Not heavier than No. 3.
Fluid Heat Inc., Baltimore, Md.	A.C.	Combustion (Minneapolis-Honeywell "Type R-103" Protectorelay or "Type DSS" motor switch with "Type A" or "Type B" combustion thermostat, or Time-O-Stat "No. 77" Lockswitch with "No. 48-C" or "No. 48-H" combustion thermostat).	Gas (expanding pilot) or electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing; also "Type A" or "B" on Minneapolis-Honeywell combustion thermostat, or "No. 48-C" or "No. 48-H" on Time-O-Stat combustion thermostat.	Not heavier than No. 3.
Franklin Oil Heating, Inc., Columbus, O.	A.C.	Anti-flooding device (own manufacture trip bucket).	Gas or oil pilot.	Gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on blower housing or base.	Not heavier than No. 1.
Grant Home Heater Corp., Jersey City, N. J.	A.C. or D.C.	Trip switch (own manufacture).	Gas.	Suction from supply tank.	Underwriters' Lab. label on burner base.	Not heavier than No. 1.
Heat-Glow Oil Burner Co., St. Louis, Mo.	A.C.	Anti-flooding device (own manufacture trip bucket).	Gas or oil pilot	Gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on blower housing or base.	Not heavier than No. 1.
International Burners Corp., New York, N. Y.	A.C.	Combustion (Minneapolis-Honeywell "Type U-10-C" Protectorelay with "Type B-3" combustion thermostat, or "Type BPRE-1" Protectorelay with "Type B-1" combustion thermostat or Time-O-Stat "No. 77" Lockswitch with "No. 48-C" combustion thermostat).	Gas (expanding pilot).	Gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on control stand; also "Type A" on burner frame; also "Type B-3" or "Type B-1" on Minneapolis-Honeywell combustion thermostat; or "No. 48-C" on Time-O-Stat combustion thermostat; also "S-2" on constant level valve or listed marking on automatic pump.	Not heavier than No. 2.
Marr Oil Heat Machine Corp., Minneapolis, Minn.	A.C.	Anti-flooding device (own manufacture trip bucket).	Gas or oil pilot	Gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on blower housing or base.	Not heavier than No. 1.
May Oil Burner Corp., Baltimore, Md.	A.C. or D.C.	Combustion (Minneapolis-Honeywell "Type DSS" program motor switch with "Type B" combustion thermostat, or Minneapolis-Honeywell "Type A" Protectorelay with "Type B" or "Type A" combustion thermostat or Minneapolis-Honeywell "Type TIR" Protectorelay with "Type A" or "Type B" combustion thermostat or Time-O-Stat "No. 77" Lockswitch with "No. 48-C" or "No. 48-H" combustion thermostat or Mercoid "Type SDP" or SDE" Adjustatherm with "Type M-1" or "Type L" combustion thermostats).	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing; also "Type A" or "Type B" on Minneapolis-Honeywell combustion thermostat or "No. 48-C" or "No. 48-H" on Time-O-Stat combustion thermostat or "Type M-1" or "Type L" on Mercoid combustion thermostat; also "Type OB" on Titeflex flexible hose couplings when used.	Not heavier than No. 3.
Mayflower Oil Burner Corp., West New York, N. J.	A.C.	Combustion (Minneapolis-Honeywell "Type A" or "Type BPR" or "Type R-103-1" Protectorelay with either a "Type A" or a "Type B" combustion thermostat or Mercoid "Type S" adjustatherm with "Type L" combustion thermostat).	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing; also "Type A" or "Type B" on Minneapolis-Honeywell combustion thermostat or "Type L" on Mercoid combustion thermostat.	Not heavier than No. 3.
Milwaukee Air Power Pump Co., Milwaukee, Wis.	A.C.	Combustion (Time-O-Stat "No. 77" Lockswitch with "No. 48-H" combustion thermostat or Minneapolis-Honeywell "Type R-103" relay with "Type A" or "Type B" combustion thermostat).	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing; also "No. 48-H" on Time-O-Stat combustion thermostat or "Type A" or "Type B" on Minneapolis-Honeywell combustion thermostat.	Not heavier than No. 3.
Oil-Elec-Tric Engineering Corp., Minneapolis, Minn.	A.C.	Combustion (Minneapolis-Honeywell "Type R-100" Protectorelay with "Type A" combustion thermostat, or Mercoid "Type SDP" Adjustatherm with "Type M-1" combustion thermostat, or Time-O-Stat "No. 77" Lockswitch with "No. 49-H" combustion thermostat).	Electric (transformer).	Suction from supply tank.	Underwriters' Lab. label on blower housing; also "Type A" on Minneapolis-Honeywell or "Type M-1" on Mercoid or "No. 48-H" on Time-O-Stat combustion thermostat.	Not heavier than No. 3.
Perfection Stove Co., Inc., Cleveland, O.	A.C.	Combustion (Time-O-Stat "No. 77" Lockswitch with "No. 48-H" combustion thermostat, or Minneapolis-Honeywell "Type BPR-1" Protectorelay with "Type B-5" combustion thermostat).	Gas (expanding pilot).	Gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on blower tube cap; also "Model C" on control unit; also "No. 48-H" on Time-O-Stat combustion thermostat, or "Type B-5" on Minneapolis-Honeywell combustion thermostat; also letter "S" on Detroit lubricator float valve.	Not heavier than No. 2.
Timken-Detroit Co., Detroit, Mich.	A.C.	Combustion (Minneapolis-Honeywell "Type A" or "Type BPRE" Protectorelay with "Type A" combustion thermostat).	Gas (expanding pilot.	Gravity from supply tank or listed automatic pump.	Underwriters' Lab. label on combination name plate on control unit relay cover and on burner unit frame; also "Model A" on gas pilot; also "Model U" or "Model 20" or "S-2" on constant level chamber; also "Type A" on Minneapolis-Honeywell combustion thermostat.	Not heavier than No. 1 for electric ignition burner; not heavier than No. 2 for gas ignition burner.

Fire at Pierce, Butler & Pierce Plant

On May 13, at the Eastwood plant of the Pierce, Butler & Pierce Mfg. Corporation, in Syracuse, N. Y., a fire of unknown origin destroyed the store room, part of the warehouse and part of the office. All important records were saved. Water damaged the foundry and machine shop, but operations in these departments were resumed the following day.

Kleen-Heet Eastern Dealers Meet

A meeting of the eastern dealers of the Winslow Boiler & Engineering Company was held at the Commodore Hotel, New York, May 3. The program included talks by William H. Rehm, president; a representative of the Commercial Credit Companies; T. C. Kyle, general sales manager; E. J. Grant, advertising manager, and C. W. Presdee, HEATING AND VENTILATING.

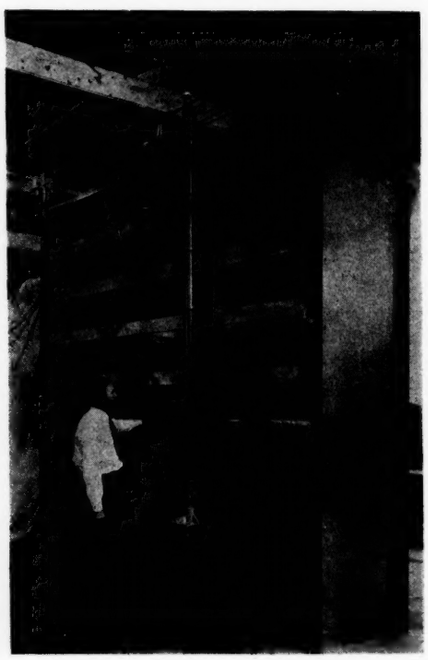
Dealers of Fire-King Stoker Company Meet

A meeting of the dealers of the Fire-King Stoker Company met at the Lincoln Hotel, Indianapolis, Ind., April 29-May 2. Between 75 and 100 distributors and dealers were in attendance. New models and new merchandising plans were discussed.

Electrical control equipment, overfeed domestic stoker, advertising and sales promotion, and a tour of local installations of the company's stokers were included in the program.

Air Filter Equipment for Chicago's Civic Opera Building

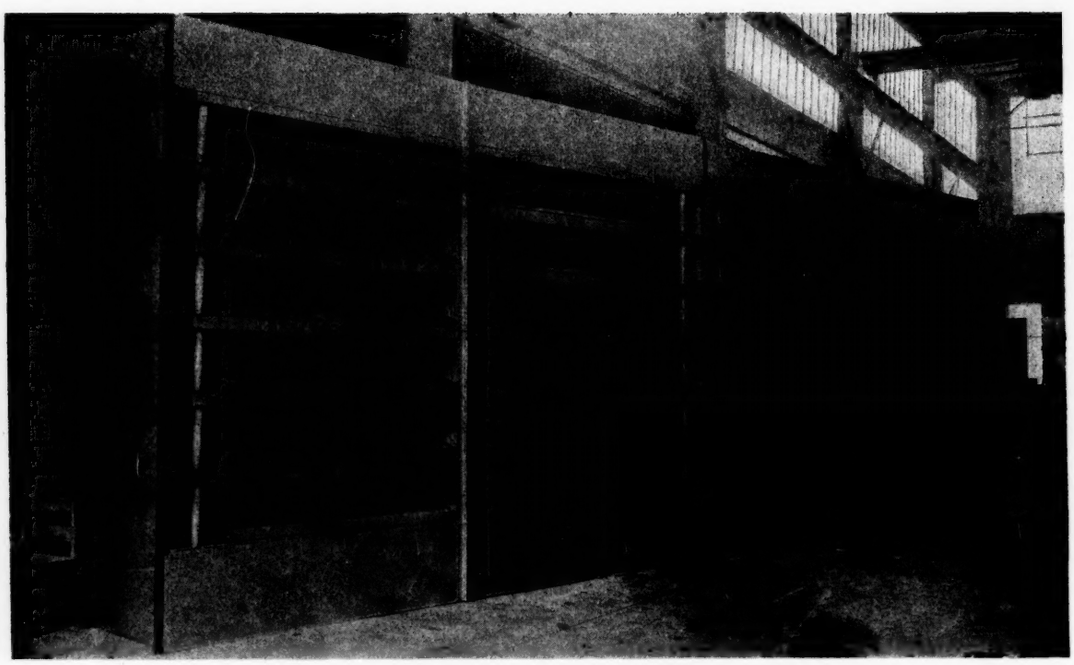
SOME idea of the air filter requirements for a modern building is gained from the equipment in the Civic Opera Building in Chicago. In this building, 17 automatic air filters are installed with a capacity for cleaning a total of 322,000 C.F.M. The filters are of the Midwest horizontal type, arranged for full automatic operation.



On account of the location of the building there is an exceptional amount of dirt in the air to be removed. Among the principal areas ventilated are: the entrance, balcony, ceiling, dressing and rehearsal rooms of the Civic Opera House proper; ceiling, balcony and foyers of the Civic Theatre; shops and rentable areas on the first floor, and the basement storage and mechanical plant, as well as the broadcasting room.

It was stated that:

"One of the most interesting features of an installation of this kind, is the almost immediate relief experienced by those in the audience who suffer from hay fever, rose fever, bronchial asthma and similar disorders. Investigations in this country and abroad have shown that many heretofore baffling disorders can be traced to air impurities. Often such innocent or ordinary causes as house and street dust cause considerable discomfort to persons who are susceptible to these particular impurities. This phase of air purification is today receiving more attention than even the saving in dollars and cents secured by longer periods between redecorating, cleaning draperies, curtains and furnishings."



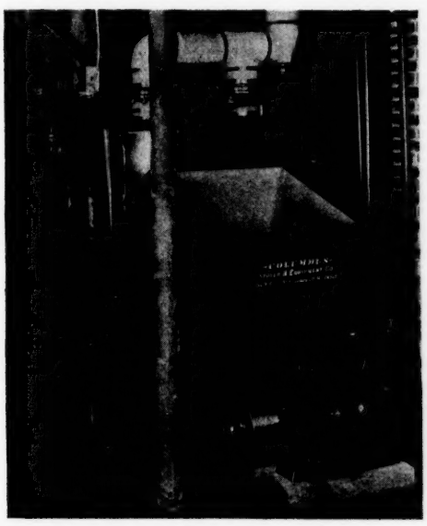
Two of the Air Filters for the Civic Opera Building in Chicago

New Apparatus and Appliances

Columbus Automatic Coal Burner

A small underfeed stoker is being manufactured by the Columbus Stoker & Equipment Corp., 154 North 5th St., Columbus, O.

Motor and fan are direct-connected to a worm on a shaft which passes through a gear box containing an automobile



Installation of Columbus Stoker in Eight-Family Apartment House

transmission geared down for feeding coal simultaneously with air. There are three speeds and a neutral position for coal feed. The heavy cast-iron fan housing and base is designed to absorb vibration and noise, and a self-contained wind box permits installations in small boilers and furnaces.

The hopper base is interchangeable for side, rear or front setting. Equipment includes a multivane type fan, Timken roller bearings, Armco rust resisting iron for the hopper and air duct, and special alloy for the coal worm.

Gears are submerged in oil and sealed, and the design of the wind box permits the installation of the burner in heaters with shaking and dumping grate where side or rear settings can be made, thus enabling removal of residue in either clinker or ash form.

The furnace can be operated under some circumstances by natural draft, this feature permitting the burning of numerous varieties of coal and permits the use of coal with a high fusing point.

Burners are made in 6 sizes, the two smaller sizes having round retorts with or without shaking grates, and the larger sizes having dead plates arranged to lock the tuyeres in place.

Capacities range from ordinary residence installations to those of 7000 sq. ft. of steam radiation.

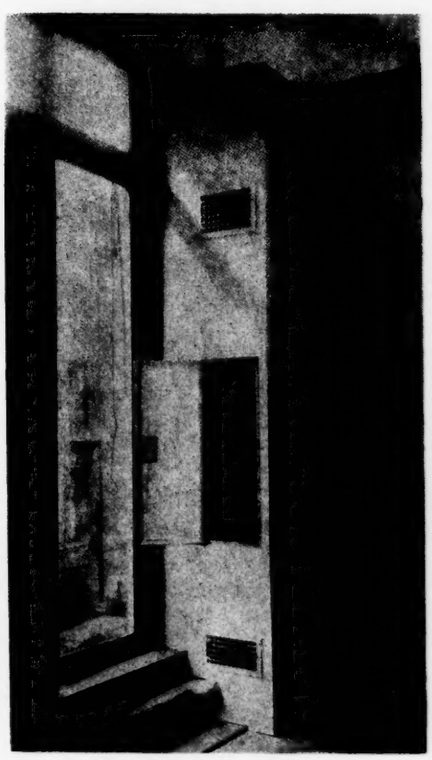
Concealed Vertical Radiator for Tall Buildings Needs No Expansion Joints

Designed by D. D. Kimball and V. J. Cucci, an extended-surface, vertical, steel radiator has been specified in several garage, office and apartment buildings in New York. The unit is marketed by Columnar Heat, Inc., 205 East 42nd St., New York, and is known as the Columnar heat unit.

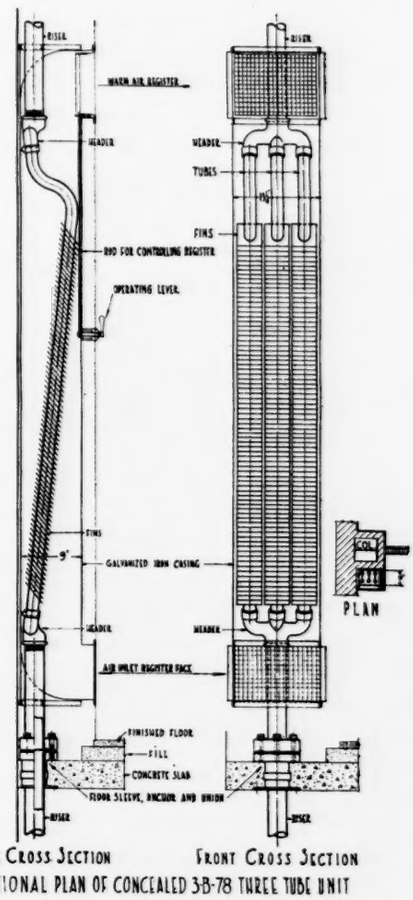
A feature of the unit is the extended surface vertical heating element, enclosed in a cabinet of small cross-sectional area, constructed of sheet metal. The unit can be installed in the masonry or in a finished steel case with enameled surface.

In the construction of the unit, interlocking fins set at an oblique angle to the axis of the pipe are applied to one, two, three or four steel tubes. At each end of the tubes is provided a header to which the tubes are welded.

Double bends in the tubes provide for



Installation of Columnar Heat Unit in Corner of Room



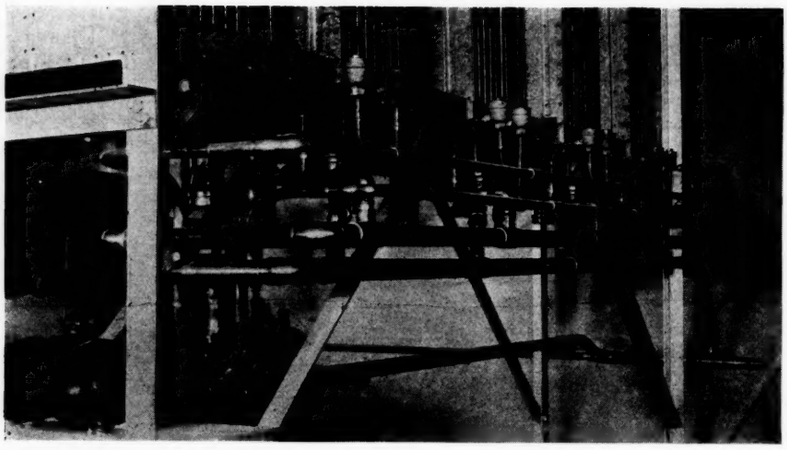
Detail of Columnar Heat Unit

the expansion and contraction of the risers, making unnecessary the installation of expansion joints and access doors. The tubes themselves constitute part of the risers, and for the purpose of assembly special floor, sleeve, anchor and joint fittings with connections are furnished. In this way the vertical radiator fulfills two functions, first that of a heating surface, and second that of part of the riser. No return risers are used, and the temperature in each room is controlled through the operation of a damper in the air space around the heating surface. Temporary heat is automatically provided by the installation of these units. Radiator branches, riser anchors, air valves, expansion joints, return risers, and half the supply riser pipe, thus are eliminated.

Columnar units have been installed in the apartment house at 51 Fifth Ave., in the Kent Automatic Garage Building, New York, and in other buildings.

Surface Combustion Company Burner Named Janitrol

It has been announced by the Surface Combustion Co., 2375 Dorr St., Toledo, O., that the name Janitrol has been selected for the Surface Combustion Gas Conversion Burner.



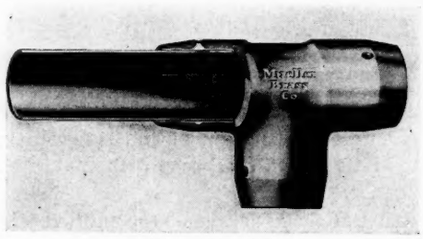
Heater Coils Connected with Mueller Streamline Fittings and Copper Tubes

Mueller Streamline Fittings

A line of streamline fittings and copper water tube, adaptable for use in low-pressure steam and water heating systems where the pressures do not exceed 15 lbs., has been announced by the Mueller Brass Co., Port Huron, Mich.

The inside surfaces of the fittings are so designed that the tubing with which the fittings are used is easily forced inside the fitting against a shoulder with a depth equal to the thickness of the tubing. The fittings have holes for the insertion of wire solder; after the wire is in place the outside of the fitting is subjected to heat from a gasoline torch, the solder being drawn around the joint by capillary action.

Use of these fittings eliminates the use of threaded joints in the pipe line, and the manner in which the tubing fits against the shoulder results in a streamline inside surface, reducing friction losses. A vibration test, run on a 10 ft. length of ¾ in. vertical pipe which contained nine joints, failed to show any sign of failure after the pipe was subjected to 850 vibrations per min., for a total of over 8,500,000 vibrations.



Sectional View of Streamline Fitting and Tube

Tubing is available in hard copper especially recommended for new and exposed jobs. For underground work and installations requiring the bending of the tubing, a softer grade is recommended.

Fittings are available in couplings, 45° and 90° elbow, reducers, tees, drop ear tees, drop ear elbow, caps and plugs.

Cutaway View of Sav-Mor Boiler

Cast-Iron Boiler for Oil-Fired Installation

Announcement has been made by the Bastian-Morley Co., La Porte, Ind., of the Sav-Mor, a cast-iron boiler for automatic oil heating. The heating surface is composed of cast-iron sections with extended surface so assembled that the flue passages are wide enough to carry off the products of combustion and narrow enough to result in sufficient rubbing action.

The base is made of heavy ribbed cast iron, well insulated, with a door to facilitate burner adjustment, lighting pilot, etc. The door also has two Pyrex glass windows so that the condition of the flame can be seen at all times. The boilers are cased in an enamel jacket finished either in red or green.

Ratings for water boilers range from 1100 to 3810 sq. ft. of radiation, in nine sizes, while the steam boilers have ratings ranging from 690 to 2380 sq. ft. of radiation in nine sizes.

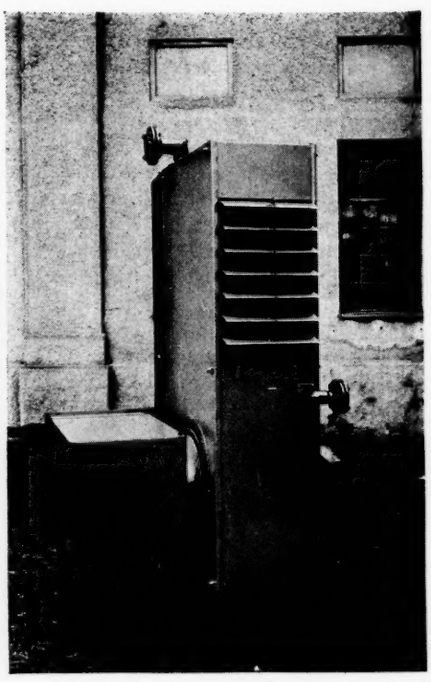
Heat in Turbine Condensate Utilized in German Unit Heater

A line of unit heaters has been placed on the market by Franz Stark & Sohne (Netzschkauer Maschinenfabrik), Netzschkau, Germany, under the trade name Nema. The units are supplied in 10 sizes with either electric motor, belt, or steam turbine drive.

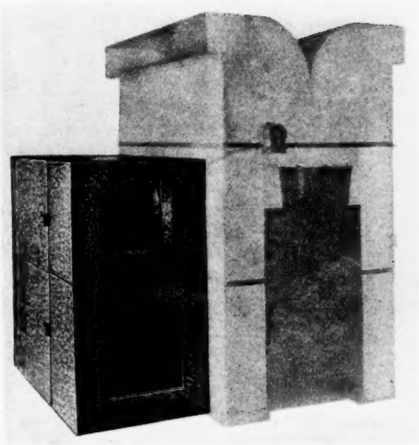
The motor drive and belt drive models are composed of the casing, heating battery (hot spelter galvanized) and centrifugal blower. Air is delivered into the room through shutters in the front side of the casing and to a smaller extent through side openings. Heaters are fitted with adjustable shutters at extra cost.

Heating surface consists of Nema tubes with forged iron spiral gills fixed to the pipe.

Steam turbine driven units are recommended where steam over 30 lb. pressure is available. The design allows the condensed steam from the turbine to flow into the battery of heating surface. It is claimed that this results in a considerable reduction in operating costs. The use of the turbine driven unit is recommended only for heating installations, and not where ventilation alone is the object.



Nema Air Heating Unit



Hess Domestic Air-Conditioning Unit

Hess Comfortaire Unit

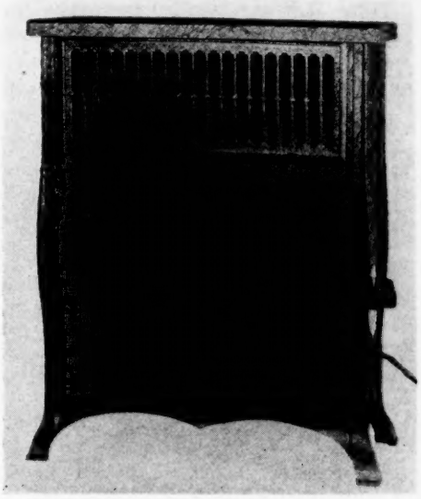
An air-conditioning unit for use with warm-air furnaces is announced by the Hess Warming and Ventilating Co., Chicago, Ill. The Comfortaire unit comes completely assembled with parts securely in place ready for connection to the furnace and electric current. A rectangular metal housing with two large doors gives accessibility to the parts and provides space for either top or side connection for the furnace cold air ducts. Inside the housing a wire mesh covered cylinder slowly revolves and picks up the water in the meshes. The blower below draws great volumes of air through two thicknesses of the wire mesh, breaking down the water films and passing the air for distribution through the leader pipes.

An automatic check valve furnishes fresh water as the water is evaporated.

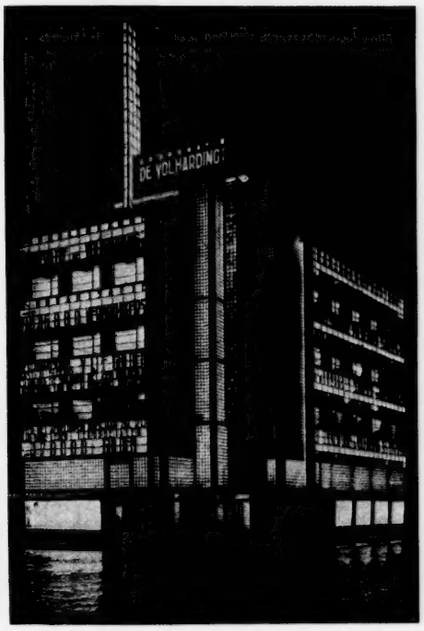
Electric Air-Way Aeriet

Heating Systems Division of Air-Way Electric Appliance Corp., Toledo, O., has announced an electric heater known as Air-Way Aeriet.

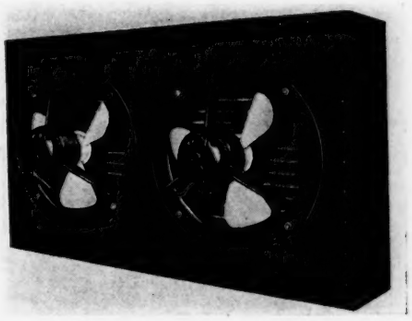
The electric heat unit is a low temperature non-glowing element, a capacitor type motor being used to operate a fan which blows the air over the heating element. The Model 14 Electric type consumes 1½ kilowatts per hour at 110 volts, equivalent to about 23½ sq. ft. of direct radiation. The device is manually controlled by a three-way switch. One turn of the switch starts the motor and creates a circulation of the air in the room, while another turns on the current to half of the element so that the air is partly heated. A third connects the remaining half of the element.



Portable Electric Model Air-Way Aeriet



Day and Night Views of Building of Glass Brick Construction



Twin Breezo-Fin Unit Heater

16-in. Twin Unit Heater

Buffalo Forge Co., Buffalo, N. Y., has announced the 16-in. Twin Breezo-Fin unit heater which has the lowest cost per unit of capacity of any unit heater made by this company.

With this unit, when desired, one of the 16-in. fans may be shut down, thus lowering the steam consumption and reducing the temperature. The heating surface is composed of Aerofin heating coils and the fans are quiet in operation. Only one set of steam and drip connections are necessary on the twin heaters.

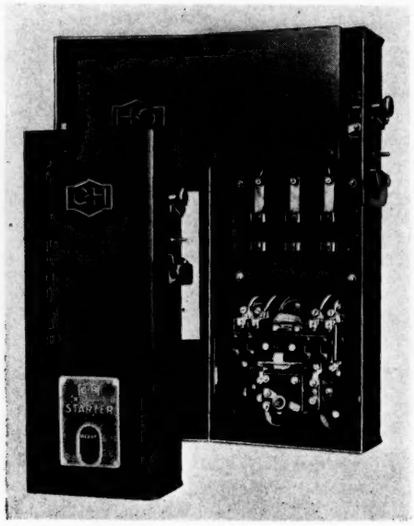
The units are available with either 1/8, 1/10 or 1/20 H.P. motors per fan, with speeds of 1440, 1150, and 860 R.P.M., respectively. The capacities range from 146,400 to 373,000 B.T.U. per hr. under 5-lb. steam pressure.

Glass Bricks

The old saw about people who, living in glass houses, should not throw stones, is beginning to take on the color of a prophecy, in view of the use of glass bricks in building materials. This product is being introduced by the Sinaco Co., New York, sole agents in the United States for the Siemens Glass Works, Dresden, Germany.

The new Siemens-solid-glass-prism-stones are made of pure white glass of high visibility and are especially made to prevent breakage. These bricks are constructed with alternate grooves, which allow the bricks to fit one into the other. If at any time it is necessary to remove a single brick, this can be accomplished without damage to the others. What is of most importance, however, to heating men, is their imperviousness to the flow of air and their low conductivity. They are of particular value in the construction of buildings where the control of heat or air is essential.

Industrial Power-Factor Problems Solved by Scale. General Electric Co., Schenectady, N. Y. This booklet contains a description of a new system announced by this company for solving power factor problems by a graphic method. A right-angle triangle is furnished with the booklet.



Cutler-Hammer Motor Starter

A. C. Motor Starter with Fusible Disconnect Switch

Cutler-Hammer, Inc., 145 12th Street, Milwaukee, Wis., announces the development of an A. C. across-the-line, automatic starter combined with a fusible disconnect switch in a single steel enclosing case. This starter can be used in place of the separate starter and fusible disconnect switch requiring less space, simplifying installation and presenting a neater appearance.

A feature is a wiring channel between the starter panel and the back of the enclosing case which allows running the connecting wires behind the panel, where they cannot interfere with the operation of the starter. All parts are mounted on a back plate which is easily removed for pulling and placing of line and motor wiring.

Direct-Reading Humidity Recorder

An instrument which records directly the humidity of the air, has been announced by the Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. It comprises two separate electric units, one designated the wet- and dry-bulb apparatus, and the other the recorder. These are connected together by suitable electrical conductors and may be placed any reasonable distance apart.

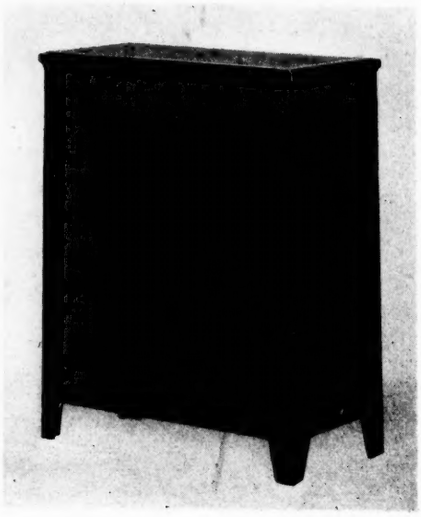
The wet- and dry-bulb apparatus comprises two similar electrical resistance thermometers mounted in a tunnel through which a stream of the air under test is drawn by a small exhaust fan. The surface of one of the thermometers is kept wet by means of a wick.

The recorder draws a continuous curve on a chart 10 in. wide, with a scale reading directly in relative humidity from 20% to 100%. Power is supplied by a 110-volt, 60-cycle synchronous motor.

Gas-Fired Warm-Air Radiator

A gas-fired warm air radiator, known as the Unit-or, recently was announced by the American Gas Products Corp., Chrysler Bldg., New York. The heating element is of cast iron with heat absorbing ribs on the inside and radiating fins on the outside. An inner covered jacket of special construction directs the heated air through an artistically designed grille in the front of the cover.

Made of heavy steel, the cover is supplied in either dark green crystalline or walnut finish. Special finishes can be supplied on request. The unit can be



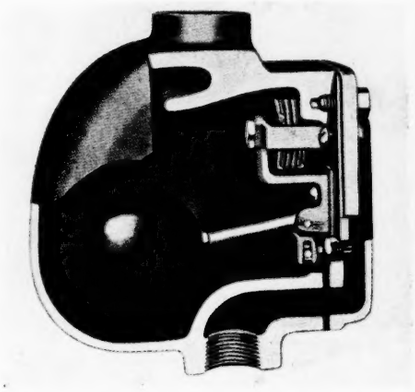
Unit-or Gas-Fired Radiator

furnished with or without thermal control to regulate the flow of gas according to the room temperature. The unit is installed in the room the same way as a radiator, and can be supplied with or without flue.

Made in three sizes, 28 in., 32 in., and 38 in., the capacities are 16,800, 21,600, and 26,400 B.T.U. per hr., respectively.

Bishop & Babcock Blast Trap

The Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O., is marketing the No. 0 and No. 00 blast traps. The former is designed for draining hot blast coils, unit heaters, dripping large mains, draining hot water generators and similar apparatus. It is a combination thermostatic and float trap, the air relief being handled by the thermostatic member and the water by the float member. Capacities range from 475 lbs. of condensation per hour at



Bishop & Babcock No. 00 Blast Trap

¼ lb. steam pressure to 2100 lbs. at 10 lbs. pressure. Standard tappings are for 1¼-in. pipe.

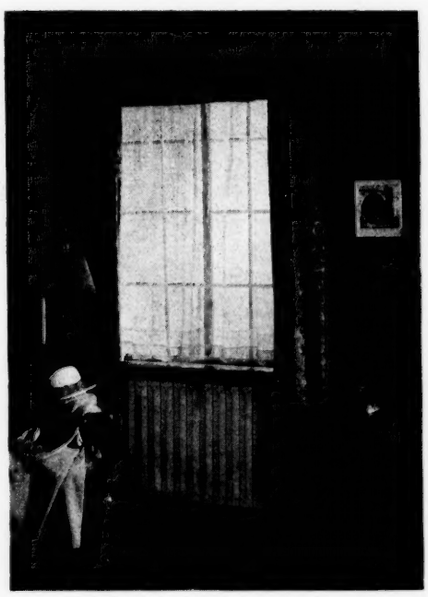
No. 00 is designed for unit heaters of the smaller sizes for draining hot blast coils and dripping steam mains. Capacities of this unit range from 200 lbs. of condensation per hour at ¼ lb. pressure to 88 lbs. at 5 lbs. pressure.

Capitol Mural Radiator

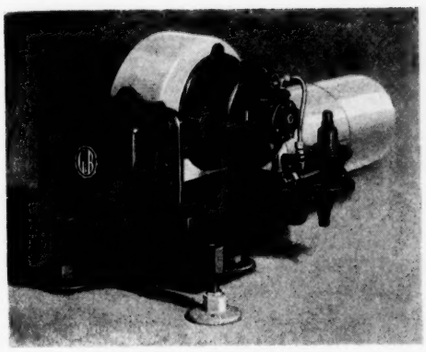
Designed for installation under a window or recessed in the wall, the Capitol Mural radiator has been announced by the United States Radiator Corp., Detroit, Mich.

The radiator is so designed that the front presents a solid appearance with the tubes behind acting as flues to speed up the circulation of warmed air. The extra face surface increases heat radiation through the lower part of the room, resulting in warmer floors and cooler ceilings.

The new radiator is available in 1, 2, 3, 4 and 5-tube types.



Installation of Capitol Mural Radiator



Gilbert & Barker Oil Burner

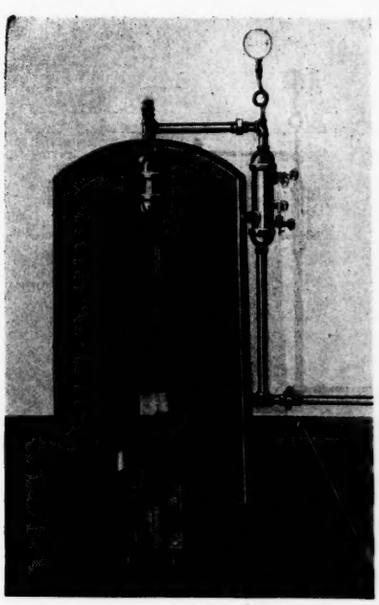
Gilbert & Barker Produces Oil-Burner

Gilbert & Barker Mfg. Co., Springfield, Mass., has announced a burner of the pressure atomizing type adapted to the use of low price fuel oil and equipped with a specially designed and patented combustion head by which the size and shape of the flame can be exactly fitted to the individual requirements of various sizes and types of heating plants. This feature is said to eliminate the necessity of building or carrying in stock three or four different sized burners, as one model handles from 300 to 4000 sq. ft. of steam radiation.

The combustion head makes possible a broad flat flame which does not touch the sides of the firebox. There is no pilot light, and the oil is ignited either by electricity alone or by electric and gas combination. The burner is exceedingly quiet in operation.

Oil-Burning Steel Boiler

Heating Systems Corp., Joliet, Ill., has announced a welded steel boiler especially designed for oil and gas burning. The boiler, which is known as the Yellow Jacket, is fabricated from low-carbon locomotive firebox steel with arc-welded joints. The unit is jacketed with steel finished in yellow Duco. It is available in seven sizes with ratings ranging from 550 sq. ft. to 1600 sq. ft. of steam radiation.

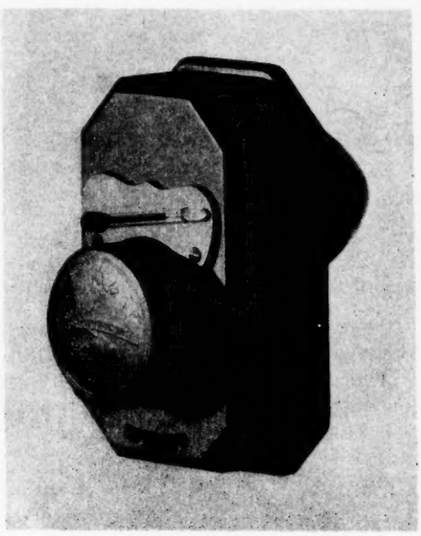


Yellow Jacket Welded Steel Boiler

Mercoid Thermostat No. 855

In the thermostat No. 855, recently announced by the Mercoid Corp., 4201 West Belmont Ave., Chicago, Ill., are embodied three features—great sensitivity, compactness and neatness.

The thermal element of the thermostat is directly exposed to the air, and is designed to give the greater sensitivity. This design eliminates the use of the ventilating apertures in the cover.



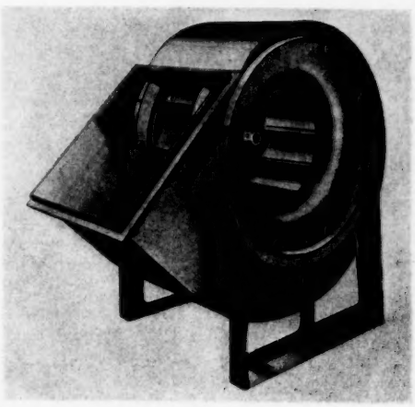
Mercoid No. 855 Thermostat

The arrangement of the mechanism reduces the size of the instrument and makes for compactness.

Equipped with a specially designed Tycos thermometer placed in an oblique position, the instrument is easily read. It requires no relay where the normal working load does not exceed 10 amperes at 110 volts or 5 amperes at 220 volts. The range of the thermostat is from 56° to 80°, with an operating differential of 1½°.

Massachusetts Streamline Power Fixed Fans

Extremely quiet operation, high operating speeds, a self-limiting horse-power characteristic, high efficiencies over a wide range and continuously rising pressure characteristics are claimed for the Streamline power-fixed fans recently placed on the market by the Massachusetts Blower Division of The Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.



Massachusetts Streamline Power Fixed Fan

Self-limiting in power consumption, each fan, at constant speed, has practically a fixed power requirement over its entire operating range, so that there is no necessity for providing a motor of excess capacity to allow for overload.

Essentially high speed machines, the Streamline fans are designed with the idea of direct connecting them to standard motors operating at speeds within the economical range.

Use of cast iron on the wheel is limited to the hub, the cone in the wheel inlet being of sheet metal. Twelve floats are welded to the back plate the full length of the contact. Similarly, the conical side band is welded to the float.

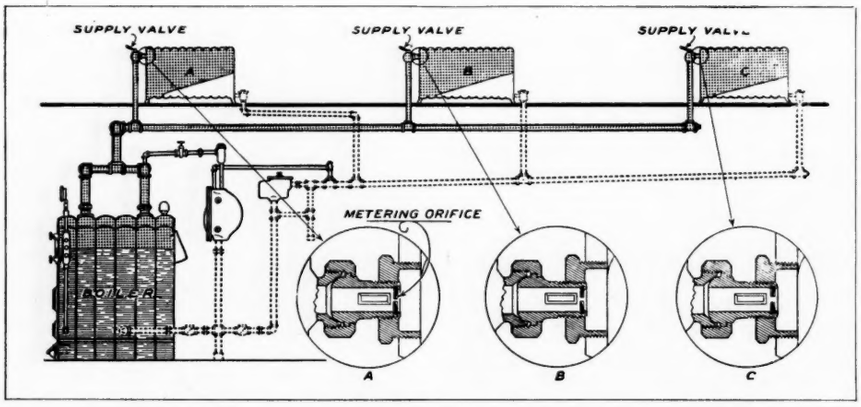
Wheel bracings are dependent upon the maximum speed at which the fan will be expected to operate, two types being available. Normal duty wheels are designed for operating speeds where the tip speed does not exceed 7000 ft. per min., while the heavy duty wheels cover the range between 7000 and 10,000 ft. per min.

The fans are made in ten sizes with capacities ranging from 980 C.F.M. to 49,100 C.F.M. at ½ in. static pressure.

Combination Electric Radiator and Cabinet

An electric radiator with cabinet which will fit over the ordinary room radiator, is announced by the Luna Metal Craft Corp., 38-40 Emerson Place, Brooklyn, N. Y. It provides auxiliary heating for the home, or any room that requires heating in mild weather without the necessity of turning up the steam or water plant. Cabinets are equipped with 500 or 1000 watt heater units, or larger if desired.

The heater element and cabinet fits over the radiator and is equipped with a humidifier in the top. The cabinet is built to order according to the exact dimensions of the radiator to be enclosed. The enclosures are finished in baked-on enamel and can be furnished in a full range of tinted enamels, mahogany, oak, walnut, etc.



Equalizing of Pressure Drop by Orifices in Improved Type R System

Webster Type R and Vacuum Systems

Warren Webster and Company, Camden, N. J., has announced the Webster vacuum system and an improved Webster type R (open return line) system. The claim is made for these improved systems that the supply of steam to each radiator is so equalized and balanced that all radiators get steam at the same time and in substantially the same proportion regardless of distance from boiler. This result is attained by the addition, to the well-known standard systems, of specially selected metering orifices in the nipple of each radiator supply valve. These orificed nipples are made in a wide range of sizes for all types of Webster supply valves.

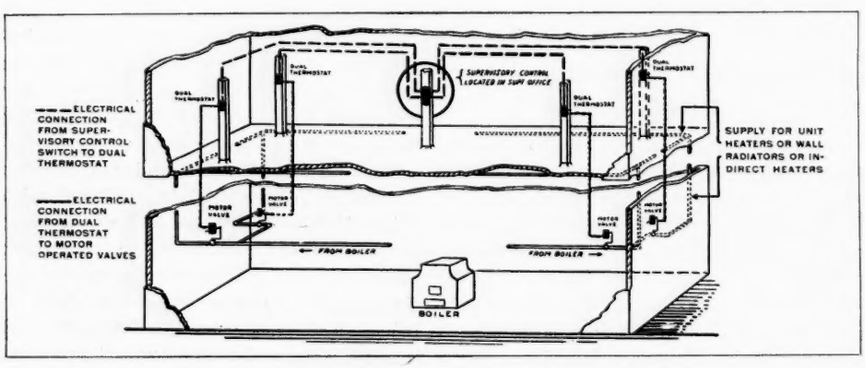
Selection of the proper size orifice is determined by the company's branch office and takes into consideration not only the amount of radiation but the distance of the radiator from the source of steam supply and the basic schedule on which the distribution piping has been sized. The entire procedure is a simplified form of that developed by the Webster Company in connection with the Webster Moderator system in which all orifices continue to be specially calculated and made-to-order for the requirements of the installation.

It is claimed for the improved systems that they meet more fully the operating requirements resulting from the use of newer fuels such as oil and gas, the newer types of light-weight radiation and the newer thermostatic controls. At the same time the heating service with existing plants having a coal fired boiler, conventional radiators and damper regulators, is distinctly improved. "Cold spots" are eliminated and any unevenness resulting from fluctuating boiler pressures and varying degrees of vacuum is smoothed out.

Zone Temperature Regulation

Zone temperature regulation with Sunday and holiday low temperature control is supplied by the supervisory control unit manufactured by the Stat-Amatic Instrument and Appliance Co., Hartford, Conn.

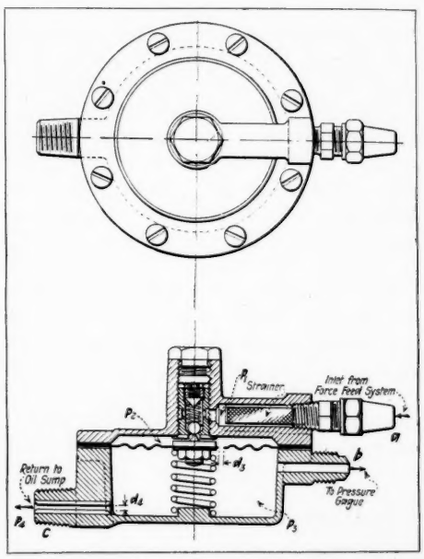
The diagram shows a typical installation in a factory where the problem of maintaining the desired temperature in different portions of the building is met by the supervisory control unit. This unit operates in connection with the dual thermostat, to change from "day" to "night" temperature levels, to hold the "night" level over Saturday and Sunday and, when a holiday occurs, over this period. One thermostat was placed in every corner of the floors and each thermostat connected to operate a motor valve in a steam line which supplies the heat in the cooler section of the building. These valves remain open until the desired temperature has been reached. When heat is being applied to the cool north side, the temperature is maintained at the desired point in other sections of the building, while the temperature is being built up in the north side. With this control it is not necessary to wind a clock, as the instrument is entirely automatic.


ELECTRICAL CONNECTION FROM SUPERVISORY CONTROL SWITCH TO DUAL THERMOSTAT
ELECTRICAL CONNECTION FROM DUAL THERMOSTAT TO MOTOR OPERATED VALVES
SUPERVISORY CONTROL LOCATED IN SUPT OFFICE
SUPPLY FOR UNIT HEATERS OR WALL RADIATORS OR INDIRECT HEATERS
FROM BOILER
BOILER

Typical Installation of Supervisory Control Switch

Device Accurately Measures Viscosity of Oil

Designed and invented by Harvey S. Konheim and W. J. Albersheim, in cooperation with C. M. Larson, the Viscosimeter has been placed on the market by the American Viscosimeter Co., 110 East 42nd St., New York. The new instrument gives indications capable of being read on a dial and gives results closely approximating the true physical viscosity more exactly than does methods now being used.



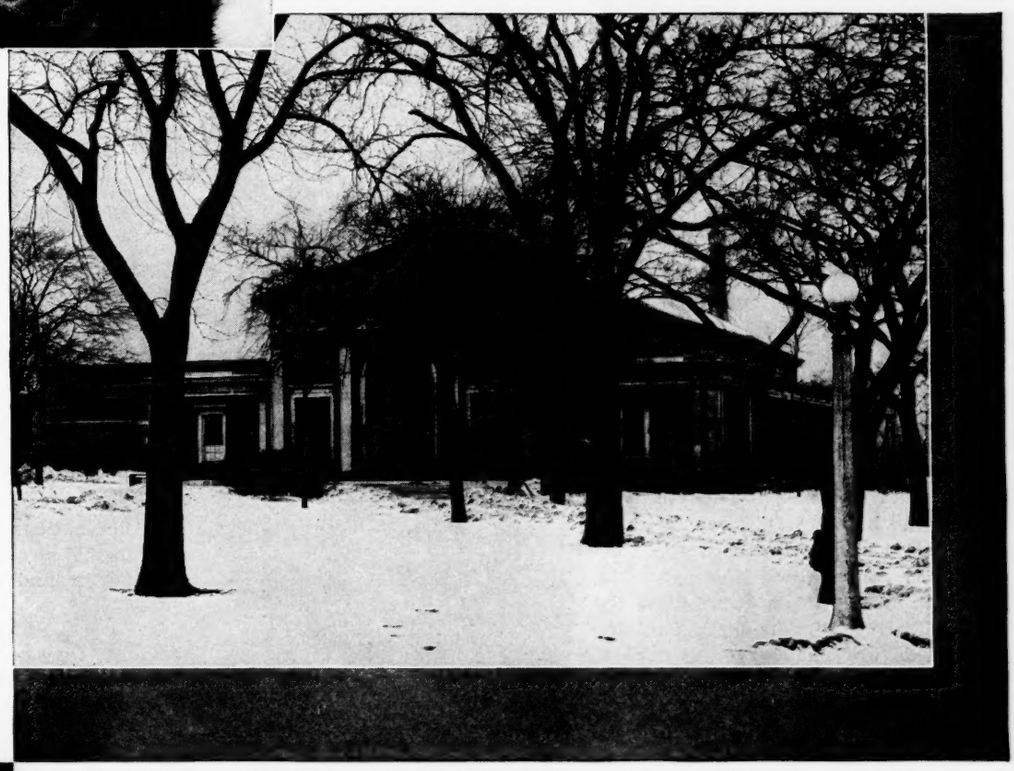
General Arrangement of Viscosimeter

The instrument consists essentially of an ordinary pressure gauge measuring the head set up by oil flowing through a friction tube at a rate held constant by a diaphragm and ball check arranged somewhat as in an ordinary reducing valve. The seating of the ball valve is controlled by a point on the diaphragm button, while oil can flow between the ball and seat into the space above the diaphragm. The latter has a small calibrated hole through which oil can get underneath the diaphragm and from there to the calibrated outlet tube. The space between the diaphragm and the outlet is connected to the pressure gauge, whose readings measure the true viscosity with a degree of precision considerably higher than that called for by practical conditions.

THE MONKEY HOUSE

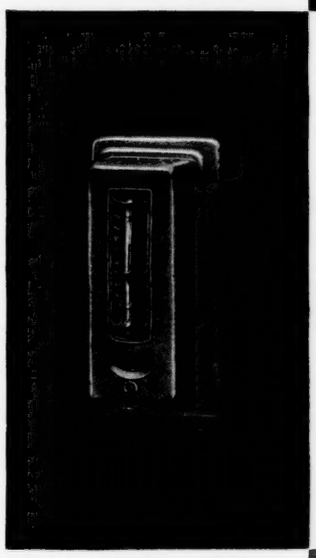
LINCOLN PARK, CHICAGO

One of the most popular places in Chicago's famous zoo is the building shown below which contains one of the rarest collections of anthropoid apes to be found anywhere. To protect their health, the heating as well as the ventilating apparatus in this building is regulated by Powers Control.



EDWIN H. CLARK
Architect and Engineer

■



MONKEYS, like human beings, are happier and healthier in the comfortable temperatures provided by the Powers System of Automatic Temperature Control.

Powers Control usually costs more; it's worth more! Because of its long service without repairs or adjustments, the user gets the largest possible return on his investment in heat control.

THE POWERS REGULATOR COMPANY

35 Years of Specialization in Temperature Control

CHICAGO: 2718 Greenview Avenue NEW YORK CITY: 137 East 46th Street

Offices in 35 Other Cities

The Canadian Powers Regulator Company, Toronto, Ontario

Powers Thermostats Are Better

Because—they need no annual adjustments or overhauling and often give 15 to 20 years of accurate control without repairs of any kind.

POWERS

Cleveland Baby Trencher

Trench Digger in Small Model

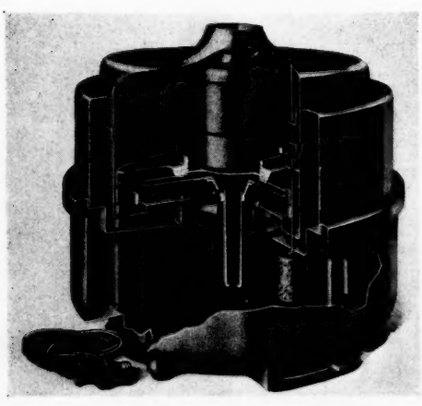
A trench digger, known as the Cleveland Baby Digger, with a width of only 58 in., is being sold by the Cleveland Trencher Co., 20100 St. Clair Avenue, Cleveland, O. The unit weighs four tons and can work over sidewalks, lawns, etc., without damage. Its length is 19 ft., and the height 8 ft. 2 in.

The speed is governed entirely by the conditions under which it is operating, the speed ranging from 9 in. to 8 ft. per min. Steering, digging-depth and digging-speeds are single-lever controlled. Lubrication is made easy and positive through the use of the Alemite system.

The company states that an average of available cost records of these machines shows a saving over hand-labor trenching of 80%.

Airite Humidifier

A household humidifier which can be placed on a table or stand is announced by Airite Corp., 50 Church St., New York. An attachment plug is provided to be inserted in the nearest outlet, and the reservoir is filled by pouring clean water into the space provided by the lip of the outer tank, until the button on the top of the water level indicator rises, indicating that the machine is filled. It evaporates water at the rate of 2½ lbs. per hr., enough to humidify the air of three or four average rooms.



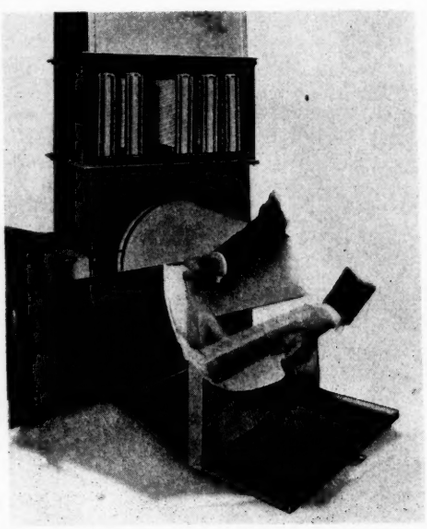
Airite Portable Humidifier

Speed control permits operation at any capacity less than maximum which may be desired. The water reservoir holds 2½ gals., usually sufficient for operation throughout one day. If the machine is left running after the water is depleted, no harm results.

Airite humidifiers can be supplied in metal casings or pottery receptacles, as desired. The pottery receptacles are available in several colors to meet any special requirements.

Airmat Filter-Fan Unit

A new development for warm-air heating recently introduced by the American Air Filter Co., Louisville, Ky., is a filter unit made of paper—sheets of fluffy wood fiber—which are easily changed and inexpensively renewed.



Filter and Blower Unit for Warm-Air Systems

Airmat, as this paper is called, has been used for two years in cleaning the air for building ventilation and industrial processes. It is supplied in standard sheets 24 in. square, and is easily handled. Soiled sheets may be burned or thrown away, whichever is most convenient.

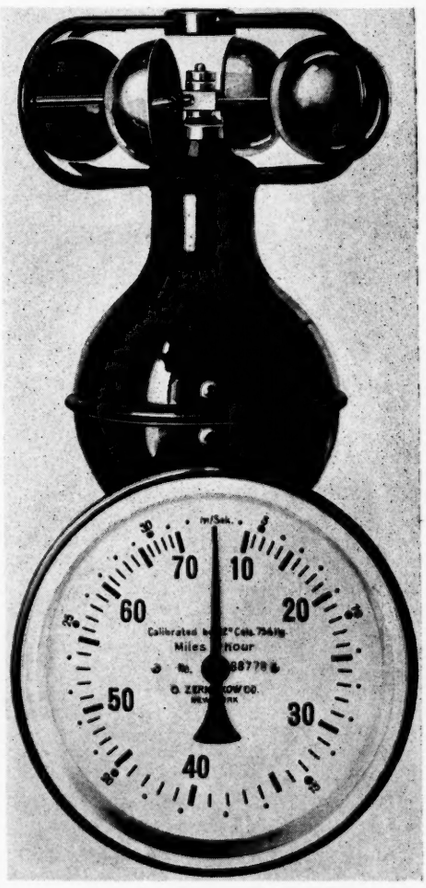
The Airmat Filter-Fan unit consists of two parts—the fan unit which includes the blower and motor, and the filter unit. The blower is of the multi-blade type, belt driven at low speed for quiet operation and mounted on oilless bearings to eliminate attention. The motor is rubber mounted and of standard manufacture.

The filter unit comprises a housing mounted directly on the fan unit, containing six Airmat pockets or holders. If the furnace is equipped with a blower the filter unit only can be furnished. The pockets are flanged and slide into metal channels, which hold them securely in place. The lower side of the pockets are open, permitting the air to pass through the filter sheets on either side where the dust and dirt are removed down into the fan unit and then to the furnace.

Standard Airmat Filter-Fan Units have a capacity of 600 to 800 C.F.M.

Air Velocity Meter

An air velocity meter, known as the O-Z Anemo Tachometer, has been announced by the O. Zernickow Co., 15 Park Row, New York. The instrument is a combination of the "Robinson" cup cross and a centrifugal tachometer. When exposed to an air current, the cup cross receives a very definite average angle velocity in such a manner that the average absolute speed of the cup center is in approximately constant relation to the wind velocity. The result is transmitted from the pendulum in the usual manner to the hand of the instrument and an accurate scale makes the reading of the wind velocity and its fluctuations easy. The plain dial has double graduation, from 10 to 70 mi. per hr. and 5 to 35 meters per sec.



O-Z Anemo Tachometer

● No 1 WALL STREET. *Architect:* Voorhees, Gmelin & Walker.
Consulting Engineer: Meyer, Strong & Jones, Incorporated.
Blower Equipment: B. F. Sturtevant Company.
Heating Contractor: Baker, Smith & Company.

in this new SKYSCRAPER . . .

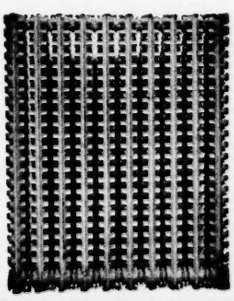
VENTO
CAST IRON HEATERS

● More than 14,000 square feet of Vento Cast Iron Heaters will be installed as part of the heating equipment in New York's newest and tallest office building.

● In making this installation the builders not only insured heaters that would operate efficiently, but would actually last as long as the building itself.

● We will be glad to send detailed information about Vento.

AMERICAN RADIATOR COMPANY
40 West 40th St., New York · 816 So. Michigan Ave., Chicago



● A typical stack of Vento

New Trade Publications

Heating Systems

Gorton Single Pipe Vapor Heating System. Gorton Heating Corp., 96 Liberty St., New York. Catalog 95 describes the company's single pipe vapor heating system, vapor trap, air eliminator, vapor draft regulator and vapor gauge, and contains illustrations of various buildings in which the Gorton vapor system is installed. Tables of dimensions are included, together with a specimen piping plant of the system. Size 4¾ in. x 7¾ in. Pp. 55.

Modernizing Obsolete Heating Systems with Webster Sylphon Attachments. Warren Webster & Co., Camden, N. J. It is generally conceded that modernization will play an outstanding part in the building industry during 1930. In Bulletin B-800, chapters on "How Modernization is Effected," and "How to Modernize Obsolete and Faulty Traps of Warren Webster and other Makes" are presented. Two interesting analysis charts showing when to modernize and the sources of waste through using obsolete heating systems are included, together with illustrations showing old, worn-out attachments and these same devices modernized. Size 8 in. x 10½ in. Pp. 15.

Zone Heating. Webster Tallmadge & Co., Inc., 50 Church St., New York. Bulletin 130 describes the Tallmadge heat zoning system with orifice distribution and electrical remote control. Installation diagrams are included, together with illustrations of office buildings and churches in which these systems have been installed. Size 8½ in. x 11 in. Pp. 24.

Wrenches

Trimo Wrenches are described in the 1929 catalog of the Trimo Mfg. Co., 55 Amory St., Roxbury, Boston, Mass. Illustrated and described are the Trimo pipe wrenches, monkey wrenches, pipe cutters, basin wrenches, chain wrenches, pipe vises, and special displays for the product. Size 8¼ in. x 5½ in. Pp. 20.

Grates

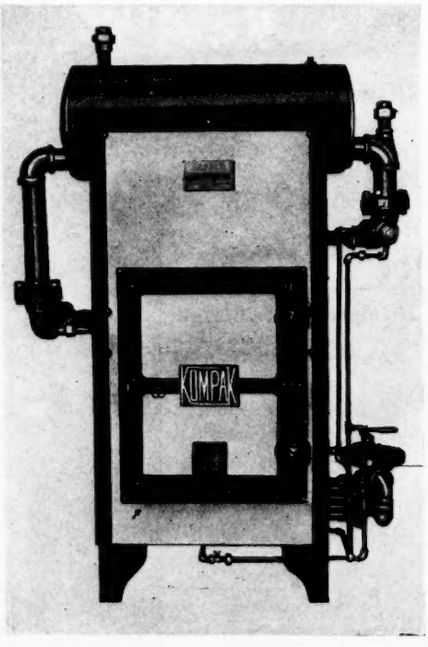
Neemes Grates. Neemes Foundry, Inc., Troy, N. Y. Bulletin 109 describes and illustrates the improved types of Neemes shaking grates and dumping grates for burning all sizes of anthracite and bituminous coals, as well as various other fuels. It also illustrates assembly and parts of recently developed structural features, and shows the adaptability to various types of heating and power boilers. Size 8¼ in. x 10½ in. Pp. 16.

Water Heating

Steam Jet Heaters for Liquids. Schutte and Koerting Co., Philadelphia, Pa. Bulletin No. 3-A describes the S & K line of steam jet heaters for water and other liquids. These jet heaters have many applications among which are the heating of special liquids for process work in manufacturing plants. Complete piping diagrams and tables of weights and dimensions are included.

Thrush System of Hot Water Heating. H. A. Thrush & Co., Peru, Ind. This folder describes the company's hot water heating system and specialties. Installation diagrams are included for the various devices, together with piping plans and tables of heat loss coefficients. Size 6½ in. x 7 in. Pp. 30.

Kompak Automatic Storage Gas Water Heaters. The Kompak Co., New Brunswick, N. J. Devoted to the subject of heating water with gas, and describes the company's line of Domestic, Brunswick, Type S, automatic circulating and Type H heaters, and the Kompak automatic devices. Diagrams of typical installations are included, together with dimensions for the various models and capacity tables for the storage tanks. Size 8½ in. x 11 in. Pp. 23.



Kompak Type S Water Heater

Ventilation

Diehl Exhaust Fans and Ventilating Equipment. Diehl Mfg. Co., Electrical Division of the Singer Mfg. Co., Elizabethport, N. J. This folder presents the Diehl line of exhaust fans and ventilating equipment, which embraces the following groups: 1—Large commercial and industrial fans (18 to 48 in. in diameter). 2—Small commercial and industrial fans (9 to 16 in. in diameter). 3—Home ventilating fans. 4—Automatic louvres and pent houses.

This folder illustrates and briefly describes each of these groups, and contains general information on installing and determining the correct size of fans.

Controls

Shallcross Furnace Draft Control. Shallcross Control Systems Co., Milwaukee, Wis. Bulletin No. 100 contains a chapter on automatic draft control and describes the Shallcross draft switch and motor drive for dampers. A cutaway drawing is included showing a typical installation of the company's furnace draft control system. Size 8½ in. x 11 in. Pp. 11.

Controlled Heat—Day and Night. Stat-Amatic Instrument and Appliance Co., Hartford, Conn. Describes the company's temperature regulators, which control the temperature for day-time conditions and the temperature at night at an economically lower setting. The change from day to night is made automatically by the clock movement of the thermostat. Installation diagrams are included for hot water, vapor, steam and warm-air systems, together with illustrations of typical installations. Size 8½ in. x 11 in. Pp. 15.

Pumps

Hazleton Centrifugal Pump Accessories. Barrett, Haentjens & Co., Hazleton, Pa. Bulletins 501, 505, 509, 512, 515, 520, 522 and 601 contain valuable information on the theory of priming, submerged pumps, the use of foot valves, air, steam and water ejectors, hand-operated priming pumps, motor-driven priming pumps and arrangement of intake piping. The bulletins are published in complete sets, bound in loose leaf form. Size 8¾ in. x 11¼ in.

La Bour Pumps. The La Bour Co., Inc., Elkhart, Ind. Bulletin No. 31 is devoted largely to a description of La Bour centrifugal self-priming pumps and contains suggestions of many different applications for the pumps. Each type is illustrated and photographs of actual installations are included, together with a table of friction of water in pipes. Size 8½ in. x 11 in. Pp. 15.

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Pressure Control and Regulation of an altogether dependable type—a friendly Control and Regulation that overcomes those old difficulties: leakage, failure-to-function, and depreciation.

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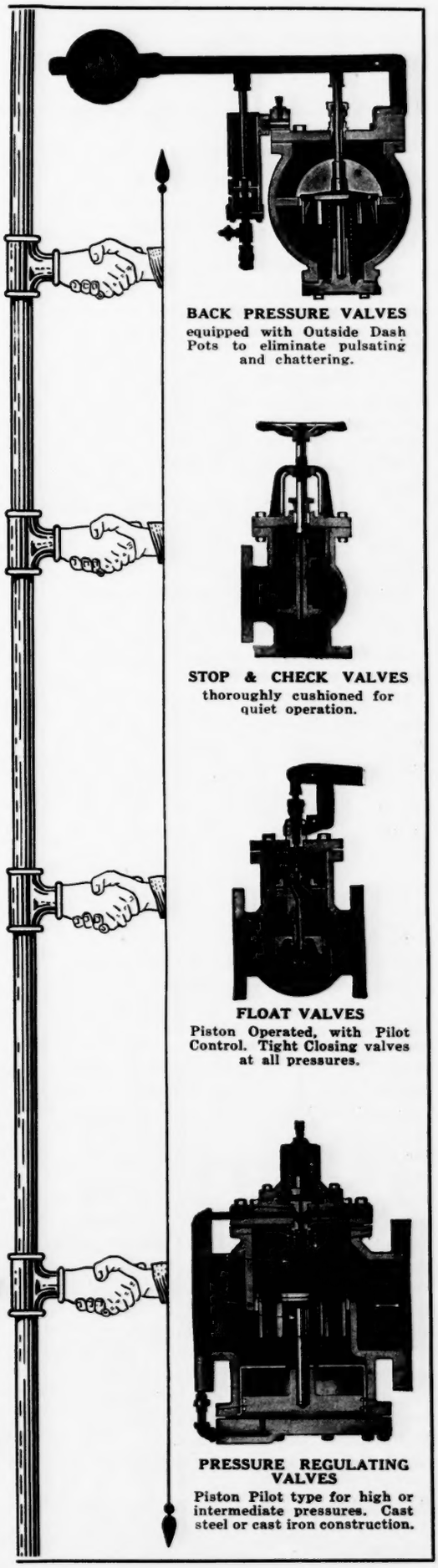

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Piston Operated, with Pilot Control. Tight Closing valves at all pressures.

PRESSURE REGULATING VALVES
Piston Pilot type for high or intermediate pressures. Cast steel or cast iron construction.

Trade and Miscellaneous Notes

Coming Events

June 9-12, 1930. Semi-annual meeting of American Society of Mechanical Engineers, at Detroit, Mich. Headquarters at the Hotel Book-Cadillac.

June 16-19, 1930. Forty-first annual convention of the Heating and Piping Contractors National Association in New York. Headquarters at the New Yorker Hotel.

June 23-27, 1930. Exposition to be held in connection with the annual convention of the National Association of Master Plumbers, in Boston, Mass. Headquarters at the Mechanics Building.

June 24-27, 1930. Summer meeting of American Society of Heating and Ventilating Engineers, Minneapolis, Minn. Headquarters at Curtis Hotel.

October 13-17, 1930. Twelfth annual convention and exhibition of the American Gas Association at Atlantic City, N. J. Headquarters at the Atlantic City Auditorium.

October 27-30, 1930. Fifty-ninth annual meeting of the American Public Health Association at Fort Worth, Tex. Headquarters at the Texas Hotel.

February 10-14, 1931. Fifth Midwestern Engineering and Power Exposition at Chicago, Ill. Headquarters at the Coliseum.

Miscellaneous Notes

April building operations for the 37 states east of the Rocky Mountains, as reported by the F. W. Dodge Corporation, show that contracts were larger than in any month since August of last year. The April record of contracts amounting to $483,251,700, was 6% greater than the total of $456,119,000 reported for March, but showed a loss of 25% from the unusually large record for April, 1929. For the first four months of this year, awards declined 17%. Analysis of this record shows that 31% of all construction was for public works and utilities, for the fourth consecutive month being the most important of all classes; 25% was for residential buildings, 15% for commercial structures, and 8% for industrial buildings.

In the New England States contracts amounted to $42,261,900, an increase of 43% over March. Figures for April of last year amounted to $40,930,200. In Metropolitan New York and Northern New Jersey, contracts amounted to $101,051,700, an increase of 13% over the total for March; the figures for April of last year were $153,113,400. Contracts awarded in Up State New York amounted to $19,870,400, showing an increase of 39% over March, and 24% over the total for April, 1929.

Figures in the Middle Atlantic States reached a total of $62,781,300, an increase of 32% over the total reported for March; in April, 1929, contracts totaled $106,136,700. In the Pittsburgh territory contracts amounted to $54,994,900, compared with $73,519,600 in March, and with the April, 1929, record of $61,013,200.

Contract figures in Southern Michigan amounted to $21,443,500, representing a 72% increase over March. Awards for April, 1929, amounted to $33,661,200. The Chicago territory had a contract total amounting to $64,758,800, compared with $67,557,500 for March, and during April of last year awards totaled $80,893,500. In the Central Northwest there was a substantial gain over the preceding month, showing a total of $10,857,300, as compared with $9,392,300. For April of last year figures totaled $13,045,000.

The St. Louis territory contracts amounted to $18,622,000, compared with the March total of $14,493,800, and the April total of $36,004,900. The Kansas City territory showed a total of $23,993,000, compared with $41,179,900 for March, and $22,053,700 for April of last year.

Texas reports contracts amounting to $22,774,100, an increase of 5% over the total for March, and 21% more than the total for April, 1929. In the New Orleans territory operations amounted to $6,377,000, compared with $10,424,300 for March, and $31,417,400 for April of last year.

Contracts in the Southeastern territory amounted to $33,465,800. This was an increase of 23% over March and 15% over April of last year.

G. Kendrick Bringhurst, Philadelphia, Pa., has opened offices as consulting engineer at 1700 Walnut Street.

C. A. Carpenter, formerly of Carpenter & Byrne, industrial equipment engineers, Pittsburgh, Pa., has opened an office as manufacturers' agent in the Park Building, Pittsburgh. Mr. Carpenter has registered as a professional engineer in power plant engineering and in heating and ventilating. He is handling the lines of the American District Steam Company, Healy-Ruff Company, Wickes Boiler Company, S. H. McKnight Company and Cork Foundation Company.

E. A. Doyle, consulting engineer of The Linde Air Products Company, was elected president of the American Welding Society at the annual meeting which was held in April.

A. M. Apmann, assistant to the director of sales and utilization of the Consolidated Gas Company of New York, has resigned to become affiliated with the Bryant Heater & Mfg. Company of Cleveland, O. Mr. Apmann sailed for Europe last month to travel for seven weeks in England, Germany, Switzerland and France. From May 26-28, he was in Stuttgart as the official representative of the American Gas Association at the annual convention of the German Gas Association. He will be in Paris from June 10-14 as the A.G.A. delegate at the convention of the French Gas Association. He also will attend the Second World Power Conference in Berlin, from June 15-25, as one of the official delegates of the College of Engineering of the New York University.

Edwards R. Fish, a prominent authority on boiler design and construction, has become associated with the Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn., as chief engineer of its boiler division. Mr. Fish, who for some time has been consultant to the boiler-engineering department of the Combustion Engineering Corporation, has served as a member of the A.S.M.E. Boiler Code Committee.

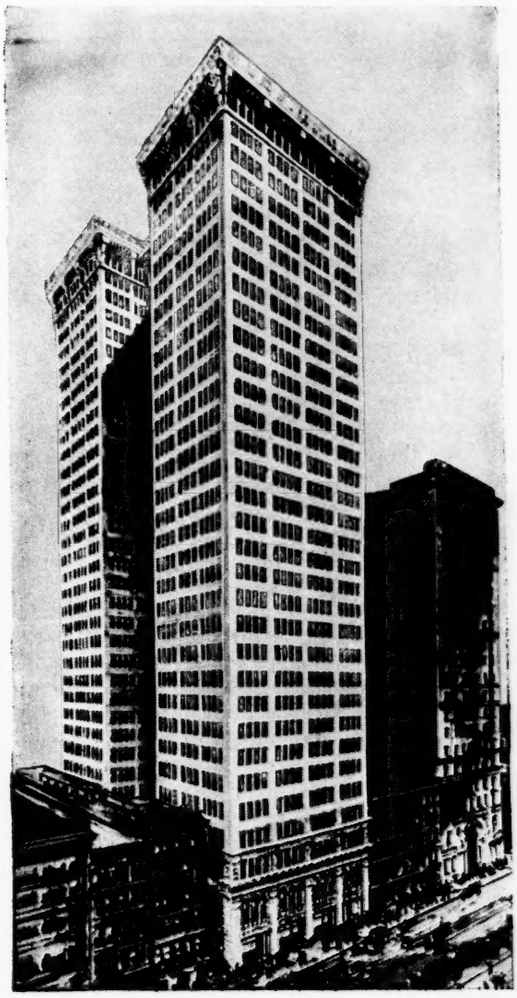
Manufacturers' Notes

Modine Mfg. Co., Racine, Wis., has appointed the following representatives: In Los Angeles, R. M. Gunzel & Co., 1015 North 8th St.; in Indianapolis, R. F. Van Alstyne, 1034 Architects Bldg.; in San Francisco, J. I. Krueger, 357-9th St.; in Atlanta, Ga., E. W. Klein, 152 Nassau St., N.W.; in Rockford, Ill., R. E. Burden, 227 Grand Ave., Loves Park.

Brunswick-Kroeschell Co., 136 Liberty St.. New York, announces the opening of new offices in the Paramount Bldg., Suite 2013, New York, for its air conditioning division under the direction of Robert A. Kroeschell and O. W. Armspach.

Reliance Electric & Engineering Co., Cleveland, O., has transferred E. A. Clark, formerly sales engineer of the Philadelphia office of the company, to the engineering department in Cleveland, where he will be engaged in the design of direct current motors.

The Brown Instrument Co., Philadelphia, Pa., announces the consolidation of its Chicago sales office and midwest ern factory branch in new quarters located at 155 East Superior Street, Chicago.

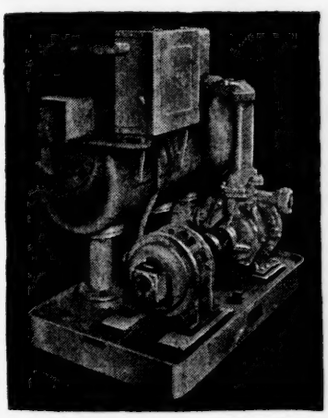


Adams Express Building, 61 Broadway, New York, N. Y. The heating system, pump and equipment in the new 33rd story were installed from plans and specifications prepared by E. H. Faile & Co., consulting engineers.

Where a pump must be silent *as well as dependable*

WHEN an entire new top floor was added to the 32 story Adams Express Building, conditions did not permit of the old heating system return risers being used. The problem of collecting the condensation arose.

This problem was solved by installing horizontal return lines and a Jennings Vacuum Heating Pump on the new 33rd floor. The pump was placed in a small closet. Through return lines extending over several hundred feet without any pitch, it



removes all the air and condensation from the radiation for 20,000 sq. ft. of floor area. Automatically controlled, it operates so quietly and with so little vibration that workers, both in the adjoining offices and on the floor below, are never aware of its presence.

Jennings Vacuum Heating Pumps are furnished in capacities of 4 to 400 g. p. m. of water and 3 to 171 cu. ft. per min. of air. For serving up to 300,000 sq. ft. equivalent direct radiation. Write for Bulletin 85.

Jennings Pumps

THE NASH ENGINEERING CO 81 WILSON ROAD, SOUTH NORWALK, CONN.

C. A. Dunham Co., Chicago, Ill., announces a recently organized subsidiary to finance heating system improvements out of the savings in fuel and other operating costs. This deferred payment business will be carried on by the American Funding Corporation, which has an authorized capital of $1,250,000, providing for the changeover of present systems of heating to Differential system operation.

Modern Coal Burner Co., Chicago, announces the appointment of T. A. Marsh, widely known combustion expert, as president of this company, which is a subsidiary of the Peabody Coal Company. For seven years Mr. Marsh served as western engineer and district representative for the Combustion Engineering Corporation. The company states that Mr. Marsh's new appointment was prompted by the swift acceptance of the smaller stoker and the increasing tendency on the part of the market to demand the highest standards of engineering supplemented by specialized combustion knowledge. New headquarters of the engineering and sales divisions will be located at 3733 Lincoln Ave., Chicago.

Wagner Electric Corp., St. Louis, Mo., announces the addition of Albert Shaw to its Salt Lake branch office sales force. Mr. Shaw, who formerly was connected with the United States Geological Survey, will specialize on coal and metal mining industries throughout the Salt Lake district.

General Regulators Corp., Kolmar and Grand Aves., Chicago, Ill., is the name of a new company formed by Guy S. Faber, formerly connected with Jas. P. Marsh & Company of Chicago.

The Trane Co., LaCrosse, Wis., is building a new factory on its Bennett Street site in that city, which will be the first unit of a plan which will ultimately cover the entire site purchased some time ago. The new building will cover 40,000 ft. of floor space, and will be of brick, steel and glass construction.

Commonwealth Brass Corp., of Detroit, Mich., which manufactures Lavigne radiator valves for steam and water heating, has opened a district sales office at 205 West Wacker Drive, Chicago, Ill., with C. A. Bierma as resident sales engineer.

McAlear Mfg. Co., 1901 South Western Ave., Chicago, Ill., has appointed as its representative in the Denver territory, the Machine & Supply Co., 1080 Broadway, Denver, Colo.

Quaker Mfg. Co., 215 North Michigan Ave., Chicago, Ill., announces that George M. Jensen has joined its staff as division manager. Mr. Jensen formerly was sales manager of the Hart Oil Burner Corporation.

Ryan, Scully & Co., 3711 Wissahickon Ave., Philadelphia, Pa., has completed plans for a new office and manufacturing building at Westmoreland and Stokley Streets, to cost approximately $100,000, and having direct connection with the Pennsylvania R. R. With these facilities equipment will be assembled and shipped from the plant, instead of assembling equipment on the job.

Pierce, Butler & Pierce Mfg. Corp., 41 East 42nd St., New York, announces that Charles P. Hackett has been appointed manager of the Baltimore branch of the company. Mr. Hackett has been connected with the industry for many years, recently being associated with the Hajoca Corporation, and prior to this being manager of the Philadelphia branch of the U. S. Radiator Corporation.

Reliance Electric & Engineering Co., Cleveland, O., has transferred J. B. Gillham and G. A. Anderson to the Los Angeles and San Francisco offices, respectively, of the Utilities Equipment Corporation, where they will handle the sales of Reliance motors. This corporation is sales and service representative for the Reliance company on the Pacific Coast.

Reeder, Eiser & Akers, consulting engineers, 916 North Charles St., Baltimore, Md., announce the formation of a partnership to be located at this address.

American District Steam Co., North Tonawanda, N. Y., has appointed Morton McI. Dukehart & Co., Inc., Baltimore, Md., as direct factory representative in the Baltimore territory.

McQuay Radiator Corp., Chicago, Ill. announces the appointment of Edward T. Ver Halen as distributor in the Milwaukee territory. Mr. Ver Halen will be located at 610 Milwaukee St., Milwaukee, Wis.

Time-O-Stat Controls Co., Elkhart, Ind., announces the appointment of Carl T. McKelvy as sales manager. Mr. McKelvy has been connected with the industry for some time, having previously served as sales manager of the American Nokol Corporation, prior to the merger of that company.

Lincoln Electric Co., Cleveland, O., announces that John C. Ardagh, R. A. Kyle and Robert Newton have been transferred from the manufacturing district to the welder service division. Mr. Ardagh will have headquarters for the Chicago district in the Monadnock Bldg., Chicago; Mr. Kyle will serve the New York district with offices at 136 Liberty Street, and Mr. Newton in the Cleveland district with headquarters at the factory.

Surface Combustion Co., Toledo, O., with which has been consolidated the Webster Engineering Company, opened an office at 447 Sutter St., San Francisco, Calif., to serve the Pacific Coast. This will be in charge of S. T. McAdams, Jr., who will have H. J. Gregg associated with him. Mr. Gregg has been transferred from the home office of the Surface Combustion Company.

Samuels Plumbing Supply Co., Boston, Mass., distributor for National Radiator Company, Richardson & Boynton Company, and Walworth Mfg. Company, and others, has opened a branch at 1957 Massachusetts Ave., Cambridge, Mass., with John J. Gwynn as manager. Mr. Gwynn formerly was with the Crane Company of Boston.

Tube-Turns, Inc., Louisville, Ky., has appointed six new distributors: Grinnell Co., Charlotte, N. C., for North and South Carolina and Georgia; Ebbert & Kirkman Co., Inc., Birmingham, Ala., for Alabama; B. Hoffman Mfg. Co., Milwaukee, for that territory; United Pipe & Supply Co., Charleston, W. Va., for that territory; Vulcan Copper & Supply Co., Cincinnati, for that territory, and Hedley & Voisinet, Buffalo, for that territory.

Nason Mfg. Co., New York, has elected Raymond Seabrook, formerly secretary of the company, as president to succeed his father, the late H. H. Seabrook. John Harmon continues as vice-president, and Thomas F. Larkin, treasurer, also assumes the office of secretary. Mr. Seabrook is the fourth member of his family to head this ninety-year old concern, founded by his grandfather, the late Joseph Nason.

Wm. B. Scaife & Sons Co., Pittsburgh, Pa., has elected Alan M. Scaife, associated with the company for the past ten years, as its president to succeed his father, the late James V. Scaife. James V. Scaife, Jr., has been elected vice-president to succeed his brother Alan.

Changes of Address

The Anthracite Institute, including the general offices and the Philadelphia district offices of the Anthracite Coal Service, the Anthracite Bureau of Information and the Anthracite Credit Bureau, will occupy the 8th floor of the Lewis Tower Bldg., 15th and Locust Sts., Philadelphia, Pa. The New York district office of Anthracite Coal Service also has established its headquarters at 90 West St., New York.

W. D. Cashin Co., Boston, Mass., announces its removal to larger quarters at 69 A Street, South Boston.

Lincoln Electric Co., Cleveland, O., has removed their Baltimore, Md., office from 432 North Calvert Street to 600 North Calvert Street. T. A. Canty is in charge of distribution in this territory and C. N. Hilbinger has been appointed sales engineer and service manager.

The Associated Business Papers, Inc., formerly located at 52 Vanderbilt Ave., New York, has moved to 295 Madison Avenue, in Suite 1112-19.

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Western Union Building, Worth and Hudson Streets, New York. *Architects*: Voorhees, Gmelin & Walker, New York. *Engineers*: Meyer, Strong & Jones, Inc., New York. *Builders*: Marc Eidlitz & Son, Inc., New York. *Heating & Ventilating Contractors:* Almirall & Co., Inc. N.Y.

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Like the Chanin, the Chrysler, the New York Life, 40 Wall Street, and other notable New York buildings, the Western Union was equipped with Sturtevant apparatus to assure ventilating service of the utmost efficiency and dependability. This and other types of Sturtevant equipment are available in a wide range of capacities, to meet almost every conceivable ventilating requirement.

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THE NEW YORK BLOWER COMPANY requires successful and experienced fan and unit heater salesmen. For further information address The Sales Manager, 3155 Shields Ave., Chicago, Ill.

Steel Heating Boiler Company with very complete lines has some territory open for sales organization or representative having had experience calling on engineers, architects and heating trade. Address Box 116, Heating and Ventilating.

MANUFACTURER'S AGENT desires to correspond with makers of Steel boilers, valves, concealed radiators and heating equipment who want representation in Western New York territory. Address Box 115, Heating and Ventilating.

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We have several openings for high class representatives to contact distributors and dealers, having exclusive selling franchises on the Wayne Oil Burner and Wayne Electric Refrigerators. Applicant must have successful record in sales together with sound engineering education. An unusual opportunity for men handling not in excess of two or three non-competitive lines. State full details of experience, territory desired and companies represented at the present time.

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WANTED FACTORY REPRESENTATIVE to handle an old established high grade line of heating and commercial valves on a commission basis. Desire men acquainted with jobbers and contractors. Some good territories open. Address The Ohio Pattern Works & Foundry Company, 2730 Spring Grove Ave., Cincinnati, Ohio.

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Only those with technical education and thoroughly experienced in one or more of the lines will be considered. Give complete history of selling experience with reference to territory covered, name of company now associated with, etc. Applications confidential.

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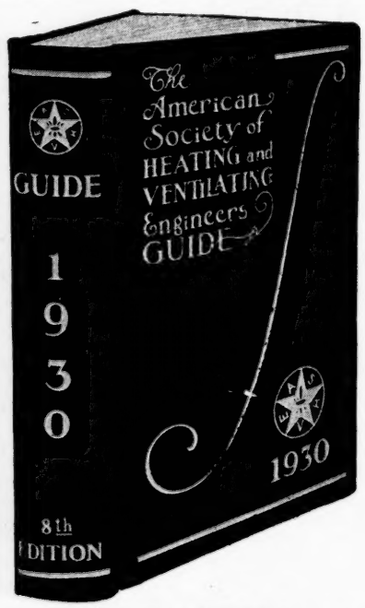

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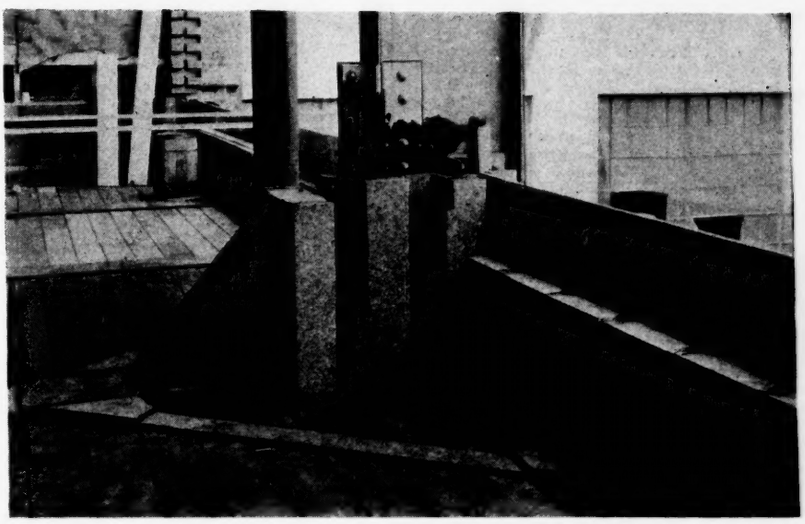
NOW BUILDINGS CAN BE VIBRATION-PROOFED

UNTIL recently, vibration-proofing has been confined to machinery—fans, pumps, engines, and motors. But now we find that the vibration and noise of an entire floor or building can be controlled by the adequate placing of cork isolation.

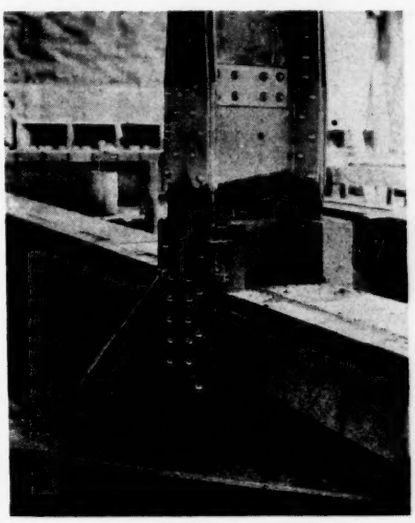
A notable example is in the Canadian Goodrich, Ltd., building at Kitchener, Ontario. Here Armstrong's Cork Machinery Isolation has been placed over beams, column bases, and floor joists to isolate the entire third floor for heavy machinery.



Armstrong's Cork Cushioning placed over beams, column bases, and floor joists to isolate the third floor of Canadian Goodrich, Ltd. B. H. and F. Prack, Hamilton, Ont., and Pittsburgh, architects.

For this purpose Armstrong's Cork Machinery Isolation is ideal. There are three densities and seven thicknesses. Consequently you can specify just the right density and thickness for the heaviest isolation job—for any vibration-proofing. And for moving machinery this advantage is particularly important. It makes no difference what the weight, speed, and action of the individual machine may be, there is a grade of machinery isolation suitable for it.

Wherever Armstrong's Cork Machinery Isolation is installed, good results are sure to come from the elimination of noise and vibration. Workers are more efficient in quieter surroundings. Machinery and building structures are protected from jar and vibration. Excessive depreciation is guarded against. In hotels, apartment houses, and office buildings, the elimination, or great reduction, of hum and vibration puts a stop to tenant complaints.



Again showing how Armstrong's Cork Machinery Isolation protects the building structure from vibration in the Kitchener, Ontario, plant.

We suggest that you write to us for further information. There are many other uses for Armstrong's Cork Machinery Isolation wherever noise and vibration make trouble. Our engineers will gladly make recommendations for special problems. If you like, we'll send you samples and literature. There's no obligation. Armstrong Cork & Insulation Co., 925 Concord Street, Lancaster, Pennsylvania.

Silencing Moving Machinery

Armstrong's Cork Machinery Isolation is used for: air compressors, blowers, drill presses, drop hammers, elevator hoists, engines, fans, forging machines, machine tools, motors, printing presses, pumps, punching machines, refrigerating machines, vacuum cleaners, and similar apparatus.

Armstrong's Cork Machinery Isolation

Heating and Ventilating Data

Subjects Covered

B.T.U. Heat Loss Tables covering Brick, Stone, Concrete Combinations, Tile, Frame Construction, etc. 21 Jones Tables Temperatures in U. S., 4 sheets. Computing Heat Losses, in Ducts and Flues, Ventilated Rooms, Fan Blast Systems, B. T. U. Example, Heating and Ventilating Calculation Sheet, and Equivalent Direct Radiating Temperature, 7 sheets. Ventilating Schools, Exhaled Air and Diffused Body Heat, Air Required to Dilute Automobile Gases, 3 sheets, Air Changes in Hospitals, Hotels, Libraries, Schools, Miscellaneous, 4 sheets. Duct and Flue Work, seven methods of sizing, Underwriter's Rules, Anemometer Readings, Velocities, Vent Flue Velocities, Duct Areas, Pipe Capacities, Elbows, Weight of Sheet Metal Pipes, Factors to Change Gauge, 24 tables. Supply and Exhaust outlets, Duct and Flue Details, Including Flue Outlets and Dampers, Details of Reversing Dampers, and Length of Ducts, Length of Fan Connection to Heater, 10 tables. Computing Radiation, Steam and Water System, The Croney Tables, Brick walls of all thicknesses, Stone and Concrete Walls of various thicknesses, Roofs, Ceilings, Floors, Indirect Steam Heating, Indirect Water Heating, Heat Emitted by Direct Radiation, by Hospital Radiators, by Wall Radiators, by Window Radiators, 42 tables. Fuel Oil, Comparative Cost, Tank Contents, Combustion Rates, 4 tables. Boilers, Horsepower and Ratios, 2 tables. Chimneys for Residences, Coal and Air, Per B. H. P. Draft Loss in Fires and Boilers, Draft Loss in Brick Stacks, Friction Losses in Steel Stacks, Examples and Costs 12 Tables. Pipe Covering, Weights, Requirements for Standard Weight Screwed Fittings, and Extra Heavy Screwed Fittings and Standard Weight Flanged Fittings, 7 tables. Flow of Steam in Pipes, Capacity of Steam Mains, Steam Pipe Sizes, Size of Return Mains, Drip Pipe Sizes, High Pressure Flow in Straight Pipes, Low Pressure Flow, High Distribution Systems, 13 tables. One Pipe Steam System, Circuit Main, Relief System, Radiator Connections, Runouts and Main Line Vents, Pipe Sizes, Capacity of Steam Mains, 10 tables. Vacuum Heating Systems, Piping Sizing, Piping Details, Radiator Connections, Pump Connections, Vacuum Pump Suction Connections, 9 tables. Gravity Water Heating, One and Two Pipe Up-Feed System, Down Feed System, Closed Tank System, One Pipe Down-Feed System, Calculations for Small Systems, Capacity of Risers, Two Pipe Circuit System, Expansion Tanks, Details, Friction Heads, 17 tables. Water Heating, Fans, Hand and Discharge, Rules for Computing, Belt Drives, Power Transmitted, Arc of Contact, Calculating Pulleys, Exhauster System, 10 tables. Steam Laundries, Hot Water Supply, Boilers, Typical Arrangement and Apparatus, 5 tables.

AN unusual opportunity to own this well known reference work. This splendid collection of tables and data on Combustion, Radiation, Heat Transmission and Losses, Ventilation, Air Changes, etc., has been used by readers of HEATING AND VENTILATING, ever since it was first featured in the editorial pages of the magazine. In fact many readers have ordered extra binders to take care of the sheets which they clipped from the paper and inserted in their sets.

Data Sheets on Heating and Ventilating

was printed a few years ago to meet the great demand for complete sets of the data sheets that had appeared up to that time. Since it was printed numerous changes have been made, and additional tables have been calculated by engineers. These have been published in the pages of the magazine but have not been included in this set.

On the other hand the editors have carefully gone over the sheets and eliminated those that have been superseded. At the left we have listed the important subjects covered in the revised set of tables now offered. The great value of these tables is attested by the fact that we are continually receiving orders from engineers and dealers for sets of tables on different subjects. These sheets are sold at $.05 each.

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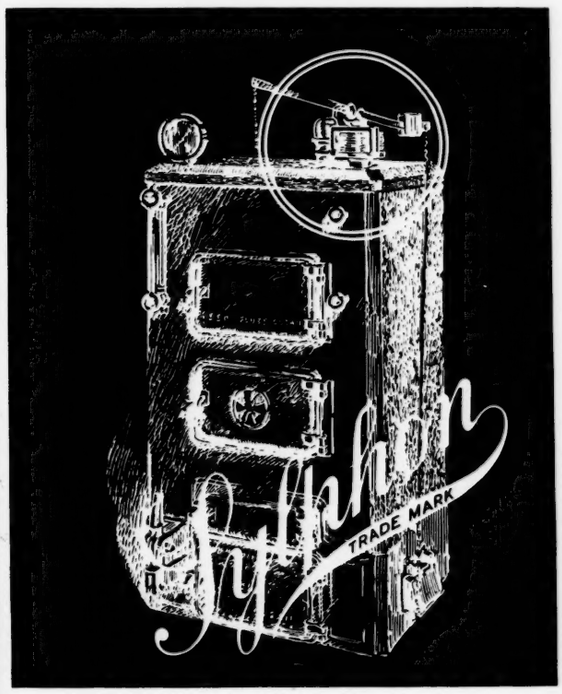

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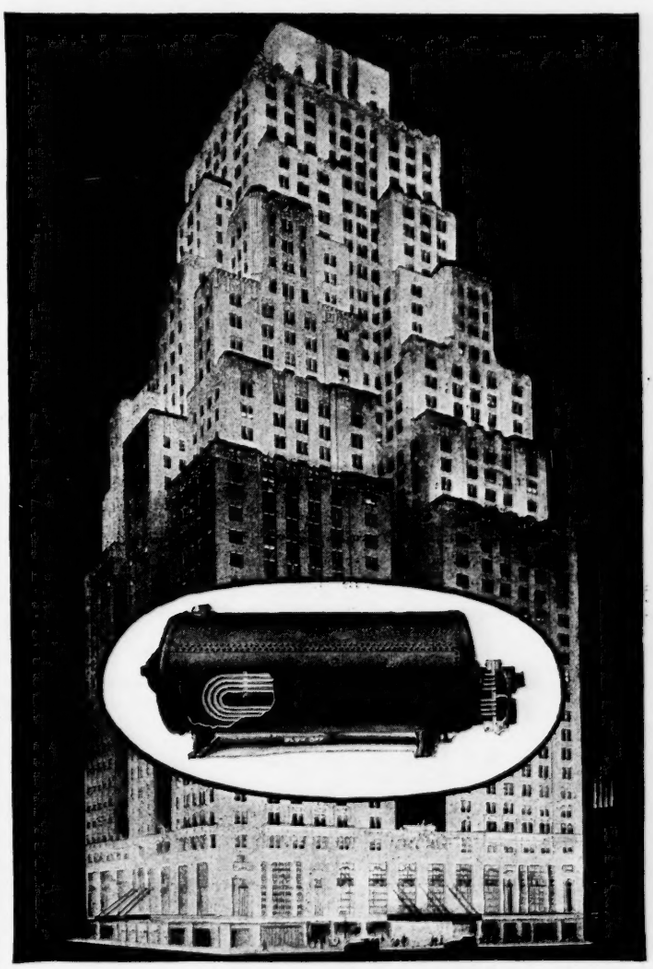

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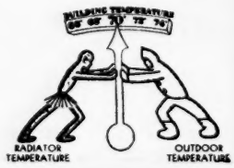

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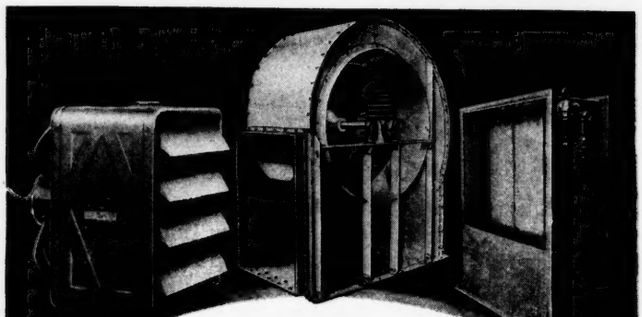

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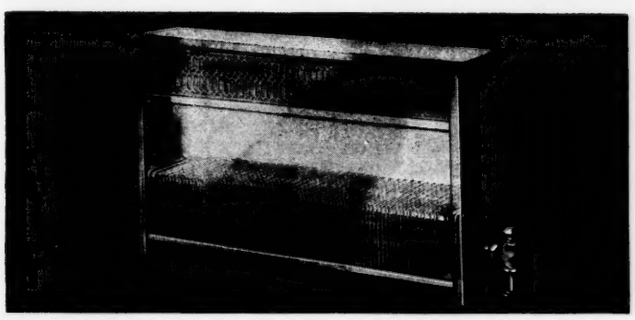

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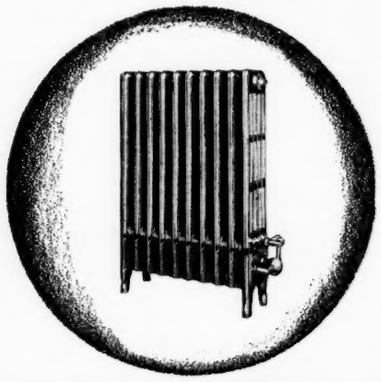

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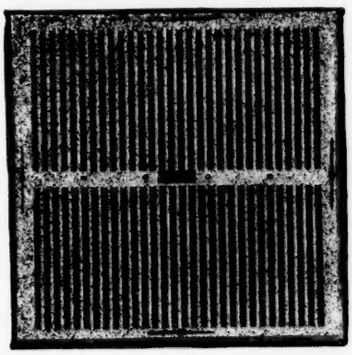

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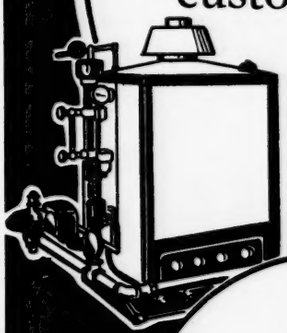

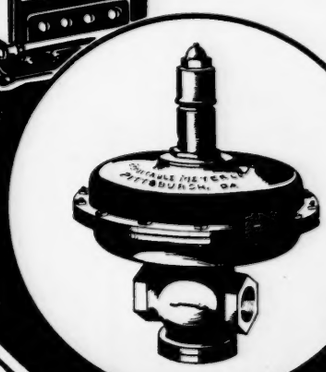

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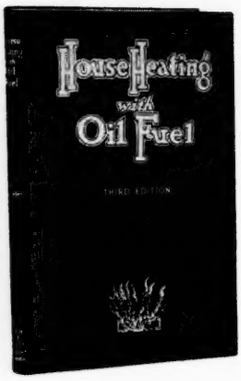

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Contents by Chapters

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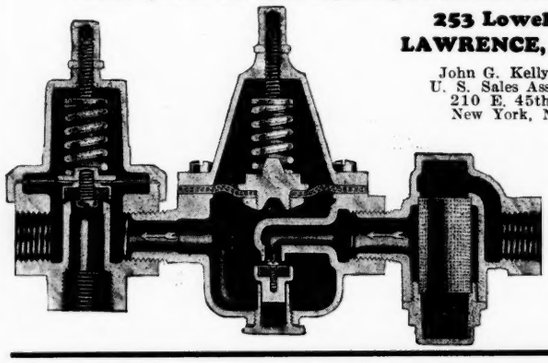

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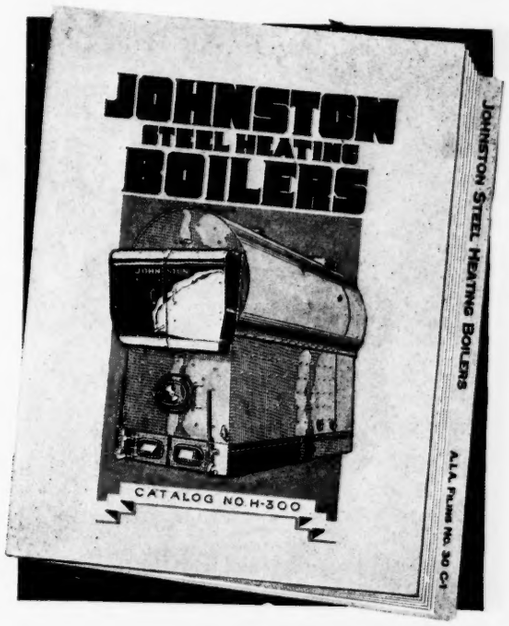
Three years ago JOHNSTON All-Steel Heating Boilers appeared on the market carefully designed to be a worthy member of a long famous group.

Today hundreds of factories, garages, theatres, hotels and apartment houses are users of JOHNSTON Boilers.



Our catalog tells the story of efficiently heating all types of buildings ranging in radiation from 1,000 to 20,000 square feet. Let us send this Catalog.

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For 20 Years

Knowles Mushrooms Have Blazed the Trail

We made the first AIR DIFFUSER for auditorium ventilation—which is still giving satisfactory service.

And we have been leading the way in improved design ever since, as is proven by our NU-NOTCH MUSHROOM, DISC-LOC GALLERY RISER VENT and AERO-VALVE AIR DIFFUSER which are chosen for their exclusive features and low cost.

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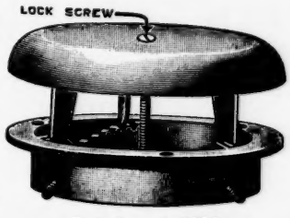
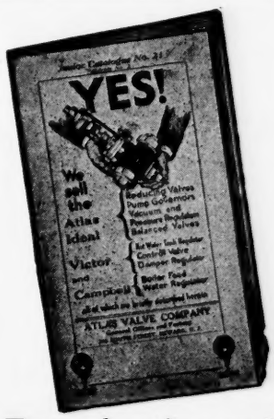
MUSHROOM VENTILATOR

NU-NOTCH is Simple, Rigid and Easily adjusted in recessed notches. For any kind of floor. Also *flat tops* for low seats.



KNOWLES MUSHROOM VENTILATOR CO.
41 No. Moore St., N. Y. City

Pat. Aug. 7, 1928



Write for this Catalog

Every heating and ventilating engineer should have a copy of this Atlas Junior Catalog No. 21. Below we list some of the products which are fully treated in the catalog. Check off those items in which you are interested, mail to us, and you will receive the catalog, prices, and whatever information you may want on any Atlas Regulating Device.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South Street, Newark, N. J.

Without obligating us in any way please send a copy of the above catalog, also information on those items marked below.

☐ Reducing Valves ☐ Pump Governors ☐ Bronze Unions
☐ Temperature Regulators ☐ Boiler Feed Regulators ☐ Thermostats
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Scientific Fundamentals, Materials
and Most Effective Methods in

Piping Handbook

By J. H. WALKER
Superintendent of Central Heating
The Detroit Edison Company
and SABIN CROCKER
The Detroit Edison Company
WITH CONTRIBUTIONS BY OTHERS

This book is intended to make available to the engineer, contractor and designer a complete handbook of the data necessary to the most effective use of piping in its many and increasingly important industrial applications.

It covers the major fields of piping completely: power plant piping, gas manufacture and distribution piping, oil field transmission lines and refinery piping, water distribution and fire-protection piping, underground steam piping, plumbing systems, and building heating systems.

764 pages, 5 x 8, illustrated, cloth bound. $5.00 Postpaid.

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1. Definitions, Formulas and Tables
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3. Metallurgy of Piping Materials
4. Pipe, Valves and Fittings
5. Heat Insulation
6. Hangers and Supports
7. Expansion and Flexibility
8. Steam Power Plant Piping
9. Building Heating Systems
10. Plumbing Systems
11. Underground Steam Piping
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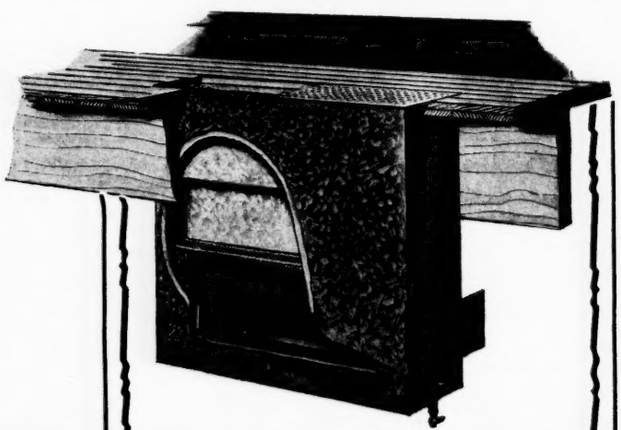
HEATING AND VENTILATING BOOK DEPARTMENT
521 FIFTH AVENUE, NEW YORK



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is a heater and humidifying device that operates with utmost simplicity.... By means of a control damper and adjustable float the proper amount of humidity for health and comfort can be properly obtained. This sturdy constructed unit may be easily installed in either old or new residences.

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Used by leading contractors everywhere.

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The Stack No-Tank

Approved by the Underwriters' Laboratories

For Hot Water House Heating Systems

Simple and economical to install on any hot water heating systems, old or new. Will operate efficiently on any 1, 2, or 3 story building.

Ask your jobber and write for Catalog No. 34

ESTABLISHED 1884

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BALL COCKS
INDIRECT HEATERS
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RELIEF VALVES
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McDermott Water Heaters

Are actually returning their entire cost every 5½ months. This saving is based upon the difference in fuel cost between McDermott and other well known heaters. Don't you want to know all about how this is accomplished? Submerged heaters were first installed in New York by McDermott.

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In a Dozen Ways It Challenges

The Brownell Master welded steel heating boiler stands alone. In a dozen ways it challenges. In it boiler building craftsmanship is at its highest level. In it a dozen advanced features command attention—

Larger fire box greater radiant heating surface and faster circulation—a special water heating feature that eliminates the costly auxiliary heater — provision for odorless garbage incineration, etc.

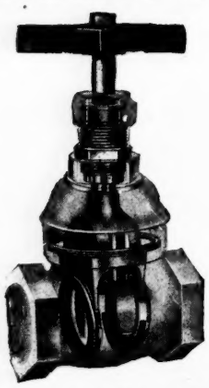
This remarkable heating unit burns coal or oil, and is an important contribution to boiler building science in a dozen different ways.

Bulletin M-66 covers it fully

The Brownell Company **Dayton, Ohio**
Established in 1855 **Representatives in Principal Cities**

BOILERS—STOKERS

FAIRBANKS VALVES



The initial cost of installing FAIRBANKS RENEWABLE RING GATE VALVES will be justified by the service rendered.

The renewable features of these valves have been perfected, are simple and may be relied upon as being entirely effective.

Renewals may be easily and quickly made, when occasions require, without taking the valve from the pipe line.

These valves are double seated and may be used with the pressure applied at either end. Can be packed under pressure, when wide open.

Write for Catalog No. 20

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Distributors Everywhere

HORNUNG

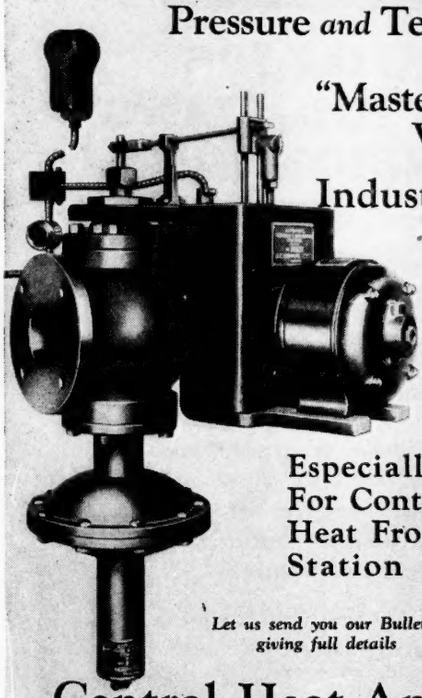
Pressure *and* Temperature

2 *in* 1

"Master Control" Valve

(PATENTED)

Industrial Type



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All Relays Eliminated ... ...

Especially Designed For Control of Steam Heat From a Central Station

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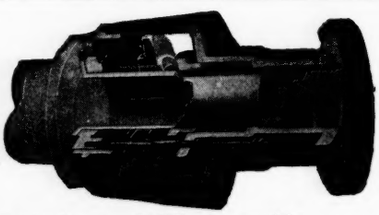
Expansion Joint

Excels in



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Shortest Way to Heating Efficiency

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A GOOD BOILER RETURN TRAP will provide the simplest and best means of returning condensation to an ordinary steam heating boiler where equipment has little or no attention.

A cheap trap of ordinary construction will sooner or later fail — a broken boiler—that's all.

The Simplex "Valve in the Head" trap with bronze and nickel steel valves and working parts is a distinctly superior piece of equipment built for lifetime service.

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FORMED steel construction of supporting ring, blades and arms gives Emerson exhaust fans great strength with light weight.

Each blade is individually trued and balanced to prevent vibration. Overlapping of blades and special design and formation of blade tips prevent air leakage and result in the discharge of a solid shaft or column of air into free air or against back pressure.

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12 inches
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Made by the Makers of Emerson 1/30 to 2 h.p. motors.

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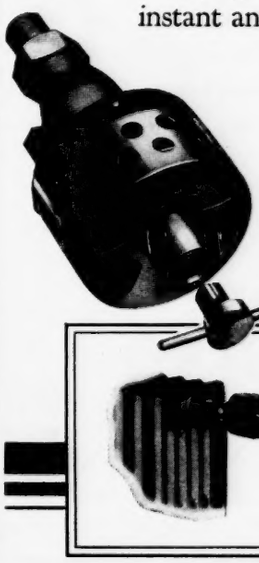
IT'S the top-sergeant — hard-boiled, tough, unrelenting— that enforces discipline upon the military individual.

— and individual discipline is as important with radiators as with men. It takes a top-sergeant to impose individual control upon the units of your heating system —and Thermotrol *does it*.

When one room needs more heat than another, Thermotrol issues the order. If a low temperature is desired in any room—Thermotrol keeps the temperature down.

Changes in wind direction and variations in outside temperature make no difference in Thermotrol equipped rooms. The response to changing heat requirements is instant and accurate.



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(Business Established 1910)

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Ozone and Electrolytic Water Sterilizers
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This Company Controls "U. S. Ozone Company Pennsylvania Charter 1920"

We shall be glad to send you Complete Information and Engineering Data.

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OHIO Motors are bought because of the Reliable Service they render. A list of Ohio Users includes many of the best known motor driven machines and appliances on the market. Price cannot be the reason, as Ohio's command a higher price. The ability to meet the most severe service conditions is the one consideration.

1/30 to 1 Horse Power

CHACE THERMOSTATIC METAL
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An accurate, consistent and durable bi-metal for temperature responsive devices up to 1500° F. Mill sheets or finished form. Consult our Eng. Dept.

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Stat-Amatic Intrument & Appliance Co.
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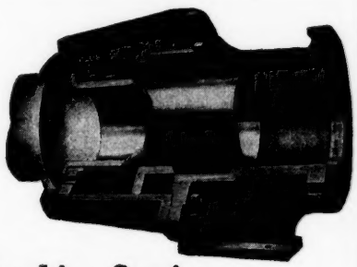
HOWARD Guided Expansion Joint



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Eliminates trouble from Expansion and Contraction, saves space, labor and repair bills; the construction is mechanically correct.

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Service The *Satisfaction*

VECO SYSTEM of VAPOR HEATING

An "Open to atmosphere" System.
The original and standard method ot
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It's Just Common Sense To Fill All The Pails At One Tap If You Can

Shopping around for boilers for this and that, is just about as sensible as getting water for each separate purpose from a different tap.

There's a Burnham long fire travel boiler for every heating need. And Burnhams, as you know, are equally fuel thrifty with coal, oil or gas as the fuel.

Send for our latest catalog of Burnham Boilers and Heating Supplies

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2—Square Boilers
3—Jacketed Boilers
4—High Pressure Boilers*
5—Junior Boilers* **
6—Laundry Stoves* **
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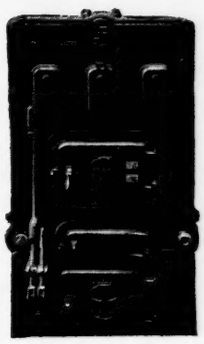
* For hot water supply.
** Also with brass fire pot.



Burnham Boiler Corporation

IRVINGTON, N. Y.

Representatives in all principal Cities of the United States and Canada

This Simplex Boiler in Washington, D. C., is one of the hundreds that are equipped and protected with the McDonnell & Miller No. 28 Self-Cleaning Duplex Feeder.

Automatic firing shouts for a boiler feeder!

PEOPLE install gas-burners, oil-burners and stokers primarily because of the **convenience** they offer. Such people want the ultimate in convenience, and it therefore becomes a duty on the part of the engineer or contractor to make the maintaining of the boiler water level **as automatic as the firing.**

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The McDonnell & Miller line has been broadened to the point where there is a feeder to meet the size, capacity and price demands of every steam, vapor or vacuum boiler. For larger jobs there is the No. 28 Self-Cleaning Rotary Valve Duplex Feeder illustrated above, and for medium and small jobs there is the McDonnell No. 30 Safety Feeder.

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Boiler Feeders
"Doing one thing well"

McDONNELL & MILLER,
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USE S & K REDUCING VALVES

for steam lines where pressures must be reduced

Auld type with diaphragm control
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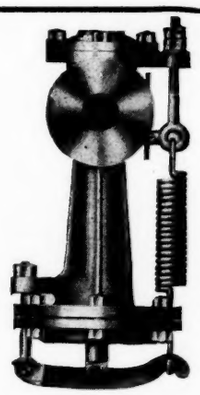

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VAPOR HEATING SYSTEM

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SEAMLESS TUBING

Wolverine Standard Copper Water Tube

Wolverine Copper Service Pipe for Underground

Wolverine Extra Heavy Copper Water Tube

Wolverine Seamless Copper, Brass and Aluminum Tubing

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ÆOLUS Improved Double Syphon Ventilators give 10% more power than formerly, according to Armour Institute Tests.

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See our detailed data in A. S. H. & V. E. Guide.

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Literature on request. Write concerning your specific problem.

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Efficient heating practices have changed with the general improvement in plant equipment and management. Hundreds of industries have proven very definitely that gas is more flexible, convenient and economical than any other known fuel for the purpose. And thousands of plants in these many industries are adding daily proof that the Humphrey Gas Unit Heater represents gas heating at the peak of its efficiency. Humphrey Gas Unit Heaters are designed by competent engineers upon the data of exhaustive research, manufactured in accordance with the well known Humphrey high standards of quality materials and craftsmanship, and bear the name of an institution which has dealt in gas heating equipment for years and years. May we send you a brochure describing them?

GENERAL GAS LIGHT COMPANY, KALAMAZOO, MICHIGAN
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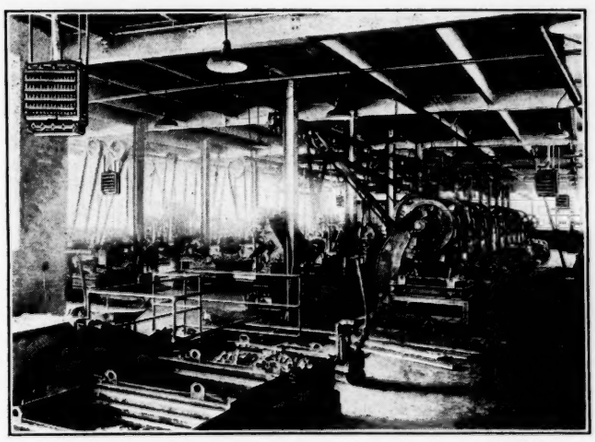

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One of the world's largest buildings, located at 40 Wall St., New York, in which has been installed FINTUBE.

FINTUBE

"The Modern Heating Unit"

FOR STEAM, VAPOR, VACUUM AND HOT WATER HEATING

Recommended for Homes, Apartments and Office and Industrial Buildings from the smallest to the largest.

Seamless hard drawn copper tubing. Copper fins are an integral part of tube. No welding, soldering, or tinning in any part of FINTUBE.

Leak-proof. Will last a lifetime. Easily cleaned with vacuum cleaner. Completely concealed within the walls.

A variety of attractive enclosures can be finished to harmonize with the decorative features of the interior.

Fintube Radiator Co., Inc.

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Please send without obligation a copy of your FINTUBE Catalog.

Name.....

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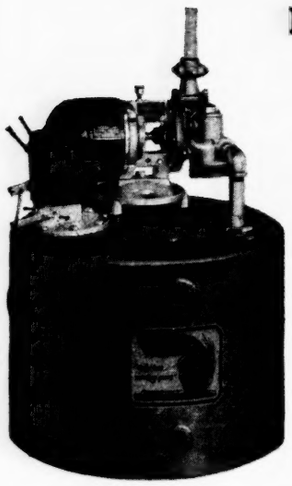
BURKS SUPER-TURBINE PUMPS

CONDENSATION RETURN UNITS

Will Not Steam-Bind



SERIES 4700

The Burks Super-Turbine pump will pump air alone, or air mixed with water to just as high a pressure as when pumping water only. Therefore, it will NOT STEAM-BIND.

Copper-bearing Steel Receiving Tank.

Cast Bronze Raceway and Impeller.

Only one moving part—the impeller—mounted on a stainless, non-corroding steel shaft mounted in oversize ball bearings.

Send for Bulletin No. 91, which describes this new Condensation Return Unit fully. Write today.

DECATUR PUMP COMPANY DECATUR, ILLINOIS

G&O FINNED TUBING

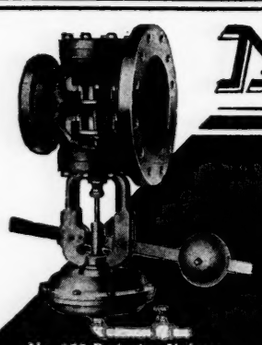
Quality Service

WE are splendidly equipped to supply all types of finned tubing for copper radiation.

CORRESPONDENCE INVITED

THE G & O MANUFACTURING COMPANY
New Haven, Conn.
Established 1915
Manufacturers of the famous "G & O" Radiators for automotive vehicles

McALEAR



No. 155 Reducing Valve—Will control sensitively and accurately for subatmospheric pressures or any reduced pressures up to 10 pounds.

. . . Up-to-the-minute—not only in completeness but also in design, engineering and construction—McAlear's Automatic Pressure and Level Controls are dependable, efficient units for ALL your specialty requirements. . . . Write for complete information.

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Sales Engineers in all Principal Cities

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MAGAZINE FEED

Veteran heating men say, they make more PROFIT for themselves and provide MORE COMFORT for their clients, when they figure and install NEWPORT magazine-feed BOILERS

You can do the same. These heaters furnish modern service. Magazine (gravity) feed—half the care. Use fuel that costs $5 or $7 less per ton—half the expense. Uniform heat—twice as satisfactory. Write today! For 1930 plan to make more sales and profit.

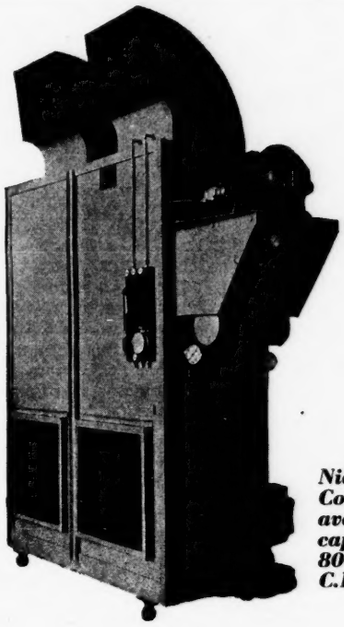
Newport Boiler Co., 400 W. Madison St., Chicago
Distributors in all principal cities

SPECIFY ROME FINNED TUBES

For Unit Heaters, Blast Heaters and Direct Copper Radiation

Send for engineering data.

ROME-TURNEY RADIATOR COMPANY, Rome, N. Y.



Niagara Air Conditioner, available in capacities from 800 to 11,000 C.F.M.

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Yes . . . and a complete AIR CONDITIONER

NIAGARA Air Conditioners are neither complicated nor cumbersome . . . they weren't meant to be. Each compact unit is a complete air conditioner in itself.

By using the Niagara method of air conditioning you eliminate costly, complicated piping and installation. You are given cleaner air than that washed by the conventional machine . . . both temperature and moisture content controlled within the closest limits . . . *secured saturation* that makes a world of difference in dehumidification and cooling.

We will be glad to give you more detailed information

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NIAGARA BLOWER COMPANY BUFFALO, N.Y.

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TO MODERNIZE THE OLD . . TO PROPERLY EQUIP THE NEW

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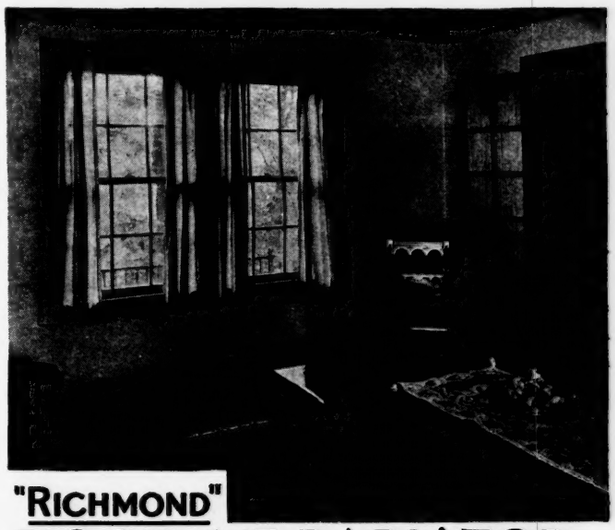

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U. S. PATENT APPLIED FOR

IN design, adaptability and effectiveness as a heating unit the Floorline radiator is decidedly unlike any other.

A long low radiator projecting heat over an extended length from the floor level. Does away with cold floors, cold corners.

Attached to the baseboard fully exposed it is but 8½ inches high, 3½ inches deep. Painted to match the base trim it is indeed unnoticeable and offers no obstruction to furniture placement. When preferred, it may be semi-recessed or completely concealed behind a grille.

The Floorline radiator may be attached to any two-pipe steam, vapor or hot water system. Its efficiencies have been tested and rated by the Carnegie Institute of Technology and the Frost Research Laboratories according to the code of the American Society of Heating and Ventilating Engineers. Mail the coupon now for catalog showing installation drawings, ratings and complete details.

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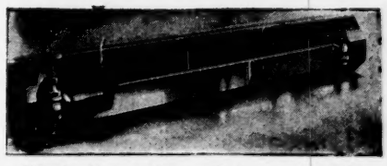
Department 6-M,
1480 Broadway,
NEW YORK, N. Y.



Illustrating valve and trap connection

You may send me illustrated descriptive booklet of the Richmond Floorline Radiator.

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Address.....

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In order that we may send the most helpful information, please check the space that identifies you:

☐ Architect ☐ Builder ☐ Heating Contractor ☐ Owner

6-M

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS
Bishop & Babcock Sales Co., Cleveland, Ohio.
Janette Mfg. Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Nash Engineering Co., So. Norwalk, Ct.
Powers Regulator Co., Chicago, Ill.

AIR CONDITIONING APPARATUS
American Air Filter Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Carrier Engineering Corp., Newark, N. J.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
U. S. Ozone Corp., Scottdale, Penn.

AIR COOLING & DRYING SYSTEMS
Air-Way Electric Appliance Corp., Toledo, Ohio.
American Air Filter Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Johnson Service Co., Milwaukee, Wis.
Modine Mfg. Co., Racine, Wis.
National Regulator Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

AIR ELIMINATORS
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Gorton Heating Corporation, New York.
Hoffman Specialty Co., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.

AIR FILTERS
American Air Filter Co., Louisville, Ky.
Staynew Filter Corp., Rochester, N. Y.

AIR SEPARATORS
Bishop & Babcock Sales Co., Cleveland, Ohio.

AIR WASHERS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

BELTING
Alexander Bros., Inc., Philadelphia, Pa.

BENDING MACHINES (ANGLES OR I-BEAMS)
David H. Smith & Sons Co., Brooklyn, N. Y.

BLOWERS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

BLOWERS, FAN
(See Fans, Supply & Exhaust).

BOILER CEMENT
Johns-Manville Corp., New York, N. Y.

BOILERS, COPPER
The Stack Heater Co., Boston, Mass.

BOILERS, HEATING, CAST-IRON, COAL BURNING
American Radiator Co., New York, N. Y.
Burnham Boiler Corp., Irvington, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Newport Boiler Co., Chicago, Ill.
Richmond Radiator Co., New York.
Weil-McLain Co., Chicago, Ill.

BOILERS, HEATING, DOWN-DRAFT, COAL BURNING
American Radiator Co., New York, N. Y.
Brownell Co., The, Dayton, Ohio.
Coatesville Boiler Works, Phila., Pa.
Kewanee Boiler Corp., Kewanee, Ill.
Pacific Steel Boilers Corp., Waukegan, Ill.
Stanwood Corporation, Cincinnati, O.
Titusville Iron Wks. Co., Titusville, Pa.

BOILERS, HEATING, GAS-FIRED
American Radiator Co., New York, N. Y.
B-Line Boiler Co., Cleveland, O.
Bryan Steam Corp., Peru, Ind.
Richmond Radiator Co., New York.

BOILERS, HEATING, MAGAZINE FEED
Gorton Heating Corporation, New York.
Newport Boiler Co., Chicago, Ill.

BOILERS, HEATING, OIL-FIRED
American Radiator Co., New York, N. Y.
Brownell Co., The, Dayton, Ohio.
Bryan Steam Corp., Peru, Ind.
Burnham Boiler Corp., Irvington, N. Y.
Coatesville Boiler Works, Phila., Pa.
Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Heggie-Simplex Boiler Co., Joliet, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Johnston Bros. Inc., Ferrysburg, Mich.
Kewanee Boiler Corp., Kewanee, Ill.
Monitor Boiler Co., Philadelphia, Pa.
Pacific Steel Boiler Corp., Waukegan, Ill.
Stanwood Corp., Cincinnati, O.
Titusville Iron Wks. Co., Titusville, Pa.
Weil-McLain Co., Chicago, Ill.

BOILERS, HEATING, STEEL, COAL-FIRED
Brownell Co., The, Dayton, Ohio.
Coatesville Boiler Wks., Coatesville, Pa.
Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Gorton Heating Corp., New York.
Heggie-Simplex Boiler Co., Joliet, Ill.
Johnston Bros., Inc., Ferrysburg, Mich.
Kewanee Boiler Corp., Kewanee, Ill.
Monitor Boiler Co., Philadelphia, Pa.
Pacific Steel Boilers Corp., Waukegan, Ill.
Stanwood Corporation, Cincinnati, O.

BOILERS, POWER
Coatesville Boiler Works, Phila., Pa.
Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corporation, Cincinnati, O.
Titusville Iron Wks. Co., Titusville, Pa.

CIRCULATORS, WATER
Janette Mfg. Co., Chicago, Ill.

COILS, PIPE
Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Walworth Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

CONDENSERS
Davis Engineering Corp., New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

CONDENSERS FOR REFRIGERATORS, COPPER
Wolverine Tube Co., Detroit, Mich.

CONDUITS, UNDERGROUND PIPE
American District Steam Co., North Tonawanda, N. Y.
Johns-Manville Corp., New York, N. Y.
Ric-wiL Co., The, Cleveland, Ohio.

CONVERTERS, HOT WATER
Davis Engineering Corp., New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

COOLERS, AIR
Alberger Heater Co., Buffalo, N. Y.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.

COOLERS, OIL
Davis Engineering Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

COOLING TOWERS & PONDS
Buffalo Forge Co., Buffalo, N. Y.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

COVERING, BOILER, PIPE, ETC.
American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
General Insulating & Mfg. Co., Alexandria, Ind.
Johns-Manville Corp., New York, N. Y.
Mineral Felt Insulating Co., Toledo, O.
Ric-wiL Co., The, Cleveland, Ohio.

DAMPER REGULATORS
(See Regulators, Damper)

DAMPERS, DUCT
National Regulator Co., Chicago, Ill.

DEHUMIDIFYING APPARATUS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Johnson Service Co., Milwaukee, Wis.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

DISTILLERS (WATER)
Davis Engineering Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

DRAFT APPLIANCES, MECHANICAL
Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
National Regulator Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

DRYING SYSTEMS
(See Air Cooling & Drying Systems).

DUST COLLECTING SYSTEMS
American Air Filter Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.

DUST COLLECTORS
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

ENGINES, STEAM
Brownell Co., The, Dayton, Ohio.
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, O.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EQUALIZING LOOPS
Hoffman Specialty Co., New York.
Sarco Co., Inc., New York.

EVAPORATORS, BOILER FEED MAKE-UP
Buffalo Forge Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

EXHAUST HEADS
Aeolus Dickinson, Chicago, Ill.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

EXHAUST SYSTEMS
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

EXPANSION JOINTS
Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., North Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Central Station Steam Co., Detroit, Mich.
Crane Co., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Walworth Co., New York.
Webster & Co., Warren, Camden, N. J.

EXPANSION SHELLS
Phillips Drill Co., Chicago, Ill.

FANS, CENTRIFUGAL
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

FANS, DISC
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

FANS, MULTI-BLADE
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

FANS, PROPELLER
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Emerson Electric Mfg. Co., St. Louis, Mo.
Hartzell Propeller Co., Piqua, Ohio.
Modine Mfg. Co., Racine, Wis.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg Co., L. J., New York.
Young Radiator Co., Racine, Wis.

FANS, STEEL PLATE
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

FANS, SUPPLY & EXHAUST
(See Fans, Supply & Exhaust).

FEEDERS, BOILER
Crane Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Walworth Co., New York.
Watts Regulator Co., Lawrence, Mass.

FILTERS, (AERATING)
Davis Engineering Corp., New York.

FILTERS, FEED-WATER
Davis Engineering Corp., New York.

FITTINGS, ACID RESISTING
Crane Co., Chicago, Ill.

FITTINGS, PIPE, FLANGED
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Walworth Co., New York.

FITTINGS, PIPE, SCREWED
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Walworth Co., New York.

FLANGES
Crane Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Walworth Co., New York.

GAS BURNERS (CONVERSION TYPE)
Cleveland Gas Burner & Appliance Co., Cleveland, O.
Columbia Burner Co., Toledo, O.
Roberts-Gordon Appliance Co., Buffalo, N. Y.

GASKETS, ASBESTOS
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville Corp., New York, N. Y.

GASKETS, METALLIC
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GASKETS, RUBBER
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GAUGE BOARDS
Bishop & Babcock Sales Co., Cleveland, Ohio.
Marsh & Co., Jas. P., Chicago, Ill.

GAUGE GLASSES
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GAUGES, ALTITUDE
American Radiator Co., New York, N. Y.
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

GAUGES, COMBINATION PRESSURE AND ALTITUDE
Bristol Co., Waterbury, Conn.
Marsh, Jas. P., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Mercoid Corp., Chicago, Ill.

GAUGES, DRAFT
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.

GAUGES, HYDRAULIC
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

GAUGES, OUNCE GRADUATED
Bristol Co., The, Waterbury, Conn.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.

GAUGES, PRESSURE
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sterling Engineering Co., Milwaukee, Wis.

GAUGES, VACUUM
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., Waterbury, Conn.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

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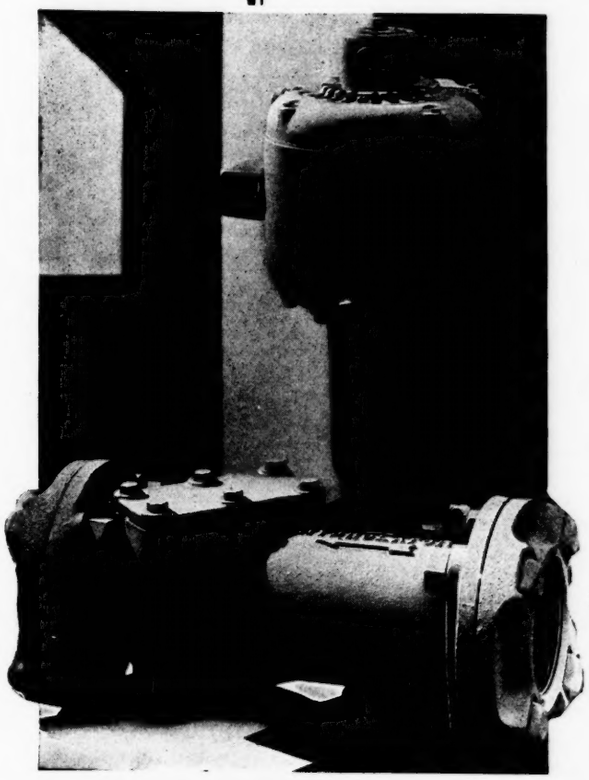

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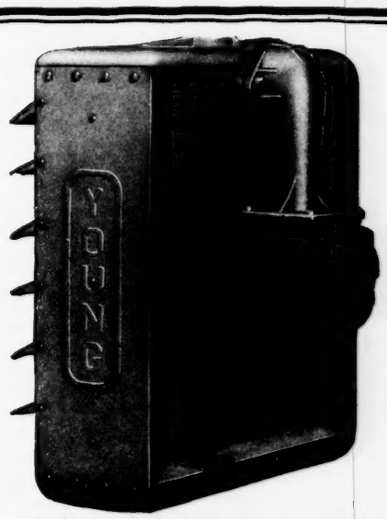

Patent No. 1753587. Other patents pending.

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Heating Division
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Representatives in Principal Cities
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Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

GAUGES, VOLUME
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

GAUGES, WATER
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Walworth Co., New York.

GENERATOR COOLING SYSTEMS
American Air Filter Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

GOVERNORS (PUMP)
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Watts Regulator Co., Lawrence, Mass.
Webster & Co., Warren, Camden, N. J.

GRATES, DUMPING
Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, ROCKING
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING
Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING AND DUMPING
Frost Mfg. Co., Galesburg, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corp., Cincinnati, Ohio.

GRATES, SHAKING, CIRCULAR
Fitzgibbons Boiler Co., Inc., New York.

GRATES, STATIONARY
Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEAT CABINETS
(See Radiators, Cabinet and Concealed)

HEATERS, AIR, FAN SYSTEM
Aerofin Corp., Newark, N. J.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Modine Mfg. Co., Racine, Wis.
New York Blower Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.
Young Radiator Co., Racine, Wis.

HEATERS, DOMESTIC WATER
Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Frank Heater & Engineering Co., O. E. Buffalo, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
McDermott Water Heaters, Inc., New York, N. Y.
Modine Mfg. Co., Racine, Wis.
Monitor Boiler Co., Philadelphia, Pa.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.
Weil-McLain Co., Chicago, Ill.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER, (CLOSED)
Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Frank Heater & Engineering Co., O. E. Buffalo, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Stanwood Corp., Cincinnati, Ohio.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER (OPEN)
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corp., Cincinnati, Ohio.

HEATERS, FUEL-OIL
Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Electrol, Inc., St. Louis, Mo.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, UNIT
Air-Way Electric Appliance Corp., Toledo, Ohio.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.
Wolverine Tube Co., Detroit, Mich.
Young Radiator Co., Racine, Wis.

HEATERS, UNIT GAS FIRED
General Gas Light Co., Kalamazoo, Mich.

HEATING SYSTEMS, GAS
Jas. B. Clow & Sons, Chicago, Ill.
Roberts-Gordon Appliance Co., Buffalo.

HEATING SYSTEMS, VACUUM
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, VAPOR
American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, O.
Gorton Heating Corporation, New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, WATER
American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Grinnell Co., Providence, R. I.
Hornung, J. C., Chicago, Ill.
Ross Heater & Mfg. Co., Buffalo, N. Y.
The Stack Heater Co., Boston, Mass.

HUMIDIFIERS
American Air Filters Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Regulator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Watts Regulator Co., Lawrence, Mass.
Woodward Co., Frank E., Boston, Mass.

HUMIDITY CONTROL
American Air Filter Co., Louisville, Ky.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Carrier Engineering Corp., Newark, N. J.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

INSTRUMENTS, ELECTRIC MEASURING
Bristol Co., The, Waterbury, Conn.

INSTRUMENTS, INDICATING AND RECORDING
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P. Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

INSULATION, BOILER, PIPE, ETC.
(See Covering, Boiler, Pipe, etc.)

INSULATION, BUILDING
Celotex Co., Chicago, Ill.
Flax-li-num Insulating Co., St. Paul, Minn.
General Insulating & Mfg. Co., Alexandria, Ind.
Insulite Co., Minneapolis, Minn.
Johns-Manville Corp., New York, N. Y.

KETTLES, COPPER
Badger & Sons Co., E. B., Boston, Mass.

MECHANICAL DRAFT APPLIANCES
(See Draft Appliances, Mechanical)

METALS, THERMOSTATIC
Chace Valve Co., W. M., Detroit, Mich.

METERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.

METERS, FEED WATER
Central Station Steam Co., Detroit, Mich.

METERS, PITOT TUBE
Buffalo Forge Co., Buffalo, N. Y.

METERS, STEAM
American District Steam Co., North Tonawanda, N. Y.

METERS, WATER, GAS, OIL & AIR
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

MOTORS (ELECTRIC)
Baldor Electric Co., St. Louis, Mo.
Century Electric Co., St. Louis, Mo.
Emerson Electric Mfg. Co., St. Louis, Mo.
Janette Mfg. Co., Chicago, Ill.
Ohio Electric Mfg. Co., Cleveland, O.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

NOZZLES, SPRAY
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

OIL BURNERS
Electrol Inc., St. Louis, Mo.
Johnson Co., S. T., Oakland, Cal.
Silent Automatic Corp., Detroit, Mich.

OIL BURNER EQUIPMENT
Buffalo Forge Co., Buffalo, N. Y.
Hornung, J. C., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Johnston Bros., Inc., Ferrysburg, Mich.
Schutte & Koerting Co., Philadelphia, Pa.

OIL BURNER IGNITION AND CONTROL EQUIPMENT
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Penn Electric Switch Co., Des Moines, Iowa.
Time-O-Stat Controls Co., Elkhart, Ind.

OZONE APPARATUS
United States Ozone Co. of America, Scottdale, Pa.

PIPE BENDING
Badger & Sons Co., E. B., Boston, Mass.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Walworth Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING (WOOD)
American District Steam Co., North Tonawanda, N. Y.

PIPE, CAST-IRON
American Radiator Co., New York.
Walworth Co., New York.

PIPE HANGERS
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Walworth Co., New York.

PIPE THREADING & CUTTING MACHINES
Crane Co., Chicago, Ill.

PIPE, STEEL
Crane Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.

PRESSURE REDUCING VALVES
(See Regulators, Pressure).

PUMPS, CENTRIFUGAL
Nash Engineering Co., So. Norwalk, Ct.

PUMPS, CENTRIFUGAL, VACUUM HEATING
Ames Pump Co., New York.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.

PUMPS, CONDENSATION
Ames Pump Co., New York.
Decatur Pump Co., Decatur, Ill.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.

PUMPS, OIL
Janette Mfg. Co., Chicago, Ill.

PUMPS, SUMP
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Ct.

PUMPS, TURBINE
Ames Pump Co., New York.
Decatur Pump Co., Decatur, Ill.
Nash Engineering Co., So. Norwalk, Ct.

PUMPS, VACUUM
Ames Pump Co., New York.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Ct.
Skidmore Corp., Chicago, Ill.

PUNCHING AND SHEARING MACHINES
David H. Smith & Sons Co., Brooklyn, N. Y.

RADIATION, LIGHT WEIGHT, NON FERROUS
American Radiator Co., New York.
McQuay Radiator Co., Chicago, Ill.
The Herman Nelson Corp., Moline, Ill
Rome Brass Radiator Corp., New York.
Rome Turney Radiator Co., Rome, N. Y.
Winchester Repeating Arms Co., New Haven, Conn.
Young Radiator Co., Racine, Wis.

RADIATOR ENCLOSURES AND SHIELDS
McQuay Radiator Corp., Chicago, Ill
Schleicher, Inc., Gary, Ind.

RADIATOR HANGERS
American Radiator Co., New York, N. Y.
Grinnell Co., Providence, R. I.
Hartmann Co., Charles, Brooklyn, N. Y
Healy-Ruff Co., St. Paul, Minn.
Kewanee Boiler Corp., Kewanee, Ill.
McAlear Mfg. Co., Chicago, Ill.

RADIATOR TUBES, COPPER
Wolverine Tube Co., Detroit, Mich.

RADIATORS, CABINET AND CONCEALED
Air-Way Electric Appliance Corp., Toledo, Ohio.
Fintube Radiator Co., Long Island City, N. Y.
Heintz Mfg. Co., Philadelphia, Pa.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
Richmond Radiator Co., New York.
Rome Brass Radiator Corp., New York.
Young Radiator Co., Racine, Wis.

RADIATORS, CAST-IRON
American Radiator Co., New York, N. Y.
Burnham Boiler Corp., Irvington, N. Y.
Crane Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Modine Mfg. Co., Racine, Wis.
National Radiator Corp., Johnstown, Pa.
Nelson Corp., Herman, The, Moline, Ill.
Richmond Radiator Co., New York.

RADIATORS, GAS-FIRED
American Radiator Co., New York, N. Y.
Jas. B. Clow & Sons, Chicago, Ill.
Richmond Radiator Co., New York.

RADIATORS, VERTICAL FIN
Wolverine Tube Co., Detroit, Mich.

RECEIVERS, AIR
Brownell Co., The, Dayton, Ohio.
Frost Mfg. Co., Galesburg, Ill.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

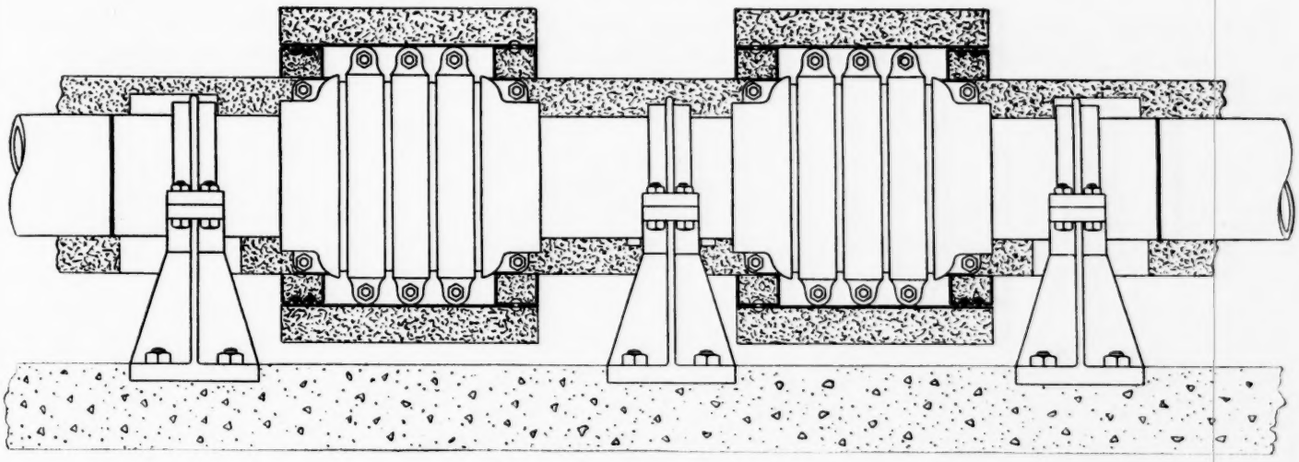
RECEIVERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

REGULATORS, BOILER-FEED
Atlas Valve Co., Newark, N. J.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, DAMPER
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Atlas Valve Co., Newark, N. J.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
The Stack Heater Co., Boston, Mass.
Sterling Engineering Co., Milwaukee, Wis.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, GAS
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

REGULATORS, PRESSURE
American District Steam Co., North Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.



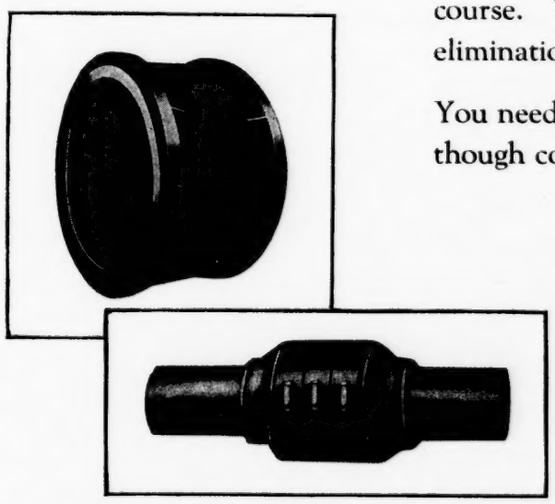
Insulating Badger Joints is a Simple Matter

SOMETIMES engineers raise the question about insulating Badger Joints. This can be easily done as was evident to those who visited our exhibition at the recent Power Show in New York.

Adequate provision is made for movements whether the joint is of the flanged or welding type. The insulating effectiveness is not impaired in any way.

The fundamental advantages of the Badger Joints are retained, of course. The non-packing feature, the protected corrugations, the elimination of steam losses, the compactness.

You need not hesitate to install Badger Joints on your lines even though complete insulation is one of the requirements.



E. B. BADGER & SONS COMPANY

67 Pitts Street, Boston, Mass.

Atlanta, Ga., Red Rock Bldg.
Charlotte, N. C., 1408 Realty Bldg.
Chicago, Ill., 2831 S. Parkway
Cleveland, Ohio, Guardian Bldg.
Cincinnati, Ohio, Union Trust Bldg.
Denver, Colo., 414 W. Colfax Ave.
Detroit, Mich., 1728 Ford Bldg.
Houston, Tex., 1308 Sec. Nat. Bk. Bldg.
Indianapolis, 312 Traction Terminal Building
Los Angeles, Cal., 517 Hollingsworth Building
Minneapolis, Minn., 732 Build. Exch.
Montreal, Que., Can. Cement Bldg.
New York, N. Y., 271 Madison Ave.
Philadelphia, Pa., 1500 Walnut St.
Pittsburgh, Pa., Union Trust Bldg.
Portland, Ore., 1000 Buyers Bldg.
Salt Lake City, Utah, Kearns Bldg.
San Francisco, Cal., Sharon Bldg.
Seattle, Wash., 415 Lenora St.
St. Louis, Mo., 3605 Laclede Ave.
Syracuse, N. Y., 404 S. Clinton St.

BADGER EXPANSION JOINTS

ESTABLISHED 1841 · WEATHER VANE ON FANEUIL HALL · E. B. BADGER & SONS COMPANY · TRADE MARK

Johnson Service Co., Milwaukee, Wis.
Kainer & Company, Chicago, Ill.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

REGULATORS, TEMPERATURE

(See Temperature Control)

REGULATOR, WATER

Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

SEPARATORS, OIL

Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illniois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Webster & Co., Warren, Camden, N. J.

SEPARATORS, STEAM

American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Webster & Co., Warren, Camden, N. J.

SPRAY COOLING SYSTEMS

Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

SPRAY NOZZLES

(See Nozzles, Spray)

STERILIZER, WATER

U. S. Ozone Corp., Scottdale, Penn.

STOKERS, MECHANICAL

Auto-Coala Corp., New York, N. Y.
Brownell Co., Dayton, Ohio.
Detroit Stoker Co., Detroit, Mich.
Domestic Stoker Co., New York.
Fire-King Stoker Co., Indianapolis, Ind.
Whiting Corp., Harvey, Ill.

STRAINERS, OIL

Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, STEAM

American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, WATER

Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

TANKS, COPPER

Badger & Sons Co., E. B., Boston, Mass.

TEMPERATURE CONTROL

American Radiator Co., New York, N. Y.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Carrier Engineering Corp., Newark, N. J.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Penn Electric Switch Co., Des Moines, Iowa.
Raymond, F. I., Chicago, Ill.
Sarco Co., Inc., New York.
The Stack Heater Co., Boston, Mass.
Stat-Amatic Instrument & Appliance Co., Hartford, Conn.
Sterling Engineering Co., Milwaukee, Wis.
Time-O-Stat Controls Co., Elkhart, Ind.
Watts Regulator Co., Lawrence, Mass.

THERMOMETERS, RECORDING AND INDICATING

American Radiator Co., New York, N. Y.
Bristol Co., The, Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

THERMOSTATIC METAL

W. M. Chace Valve Co., Detroit, Mich.

THERMOSTATS

Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Johnson Service Co., Milwaukee, Wis.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Modine Mfg. Co., Racine, Wis.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Stat-Amatic Instrument & Appliance Co., Hartford, Conn.
Time-O-Stat Controls Co., Elkhart, Ind.

TRAPS, BUCKET

Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.

TRAPS, FLOAT

Crane Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.

TRAPS, FLOAT & THERMOSTATIC

Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York, N. Y.

TRAPS, INVERTED BUCKET (STEAM AND AIR)

Armstrong Machine Wks., Three Rivers, Mich.

TRAPS, LIFTING

Crane Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.

TRAPS, RADIATOR

American District Steam Co., North Tonawanda, N. Y.
Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville Corp., New York, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York City.
Webster & Co., Warren, Camden, N. J.

TRAPS, RETURN

American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

TRAPS, STEAM

American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville Corp., New York, N. Y.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.

TRAPS, VACUUM

Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

TUBING, COPPER AND BRASS

Crane Co., Chicago, Ill.

TUBING, SEAMLESS, COPPER, BRASS AND ALUMINUM

Wolverine Tube Co., Detroit, Mich.

TURBINES, STEAM

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

TURBO-BLOWERS

Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

UNIT HEATERS

(See Heaters, Unit)

VACUUM CLEANING APPARATUS

American Radiator Co., New York, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VALVES, ACID RESISTING

Crane Co., Chicago, Ill.

VALVES, AIR, AUTOMATIC

American Radiator Co., New York, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

VALVES, AIR RELIEF

American Radiator Co., New York, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Gorton Heating Corp., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Sarco Co., Inc., New York.
The Stack Heater Co., Boston, Mass.

VALVES, BACK PRESSURE

Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, BALANCED

Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.

VALVES, BLOW-OFF

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Lytton Mfg. Corp., Franklin, Va.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Walworth Co., New York.

VALVES, CHECK

Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, DIFFERENTIAL RELIEF, GAS

Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

VALVES, FLOAT

Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Time-O-Stat Controls Co., Elkhart, Ind.
Watts Regulator Co., Lawrence, Mass.

VALVES, GATE

American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
Walworth Co., New York.

VALVES, GLOBE, ANGLE & CROSS

Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh Valve Co., Dunkirk, N. Y.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, HYDRAULIC-OPERATING

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
Walworth Co., New York.

VALVES, MAGNETIC

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Time-O-Stat Controls Co., Elkhart, Ind.

VALVES, NON BY-PASS

The Stack Heater Co., Boston, Mass.

VALVES, NON-RETURN

Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Walworth Co., New York.

VALVES, RADIATOR

American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Gorton Heating Corp., New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Vapor Engineering Co., New York.
Walworth Co., New York.
Webster & Co., Warren, Camden, N. J.

VALVES, PRESSURE REDUCING

(See Regulators, Pressure)

VALVES, REGULATING

Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kainer & Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Walworth Co., New York.

VALVES, RELIEF (WATER)

Crane Co., Chicago, Ill.
Kainer & Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
The Stack Heater Co., Boston, Mass.

VALVES, SAFETY

American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., New York, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
The Stack Heater Co., Boston, Mass.
Time-O-Stat Controls Co., Elkhart, Ind.
Walworth Co., New York.

VALVES, STOP AND CHECK

(See Valves, Non-Return)

VALVES, VACUUM RELIEF

The Stack Heater Co., Boston, Mass.
Watts Regulator Co., Lawrence, Mass.

VENTILATING SYSTEMS

American Radiator Co., New York, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
National Regulator Co., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

VENTILATORS

Bayley Blower Co., Milwaukee, Wis.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VENTILATORS, FLOOR

Aeolus Dickinson, Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Knowles Mushroom Ventilator Co., New York.
Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF

Aeolus Dickinson, Chicago, Ill.

VENTILATORS, UNIT

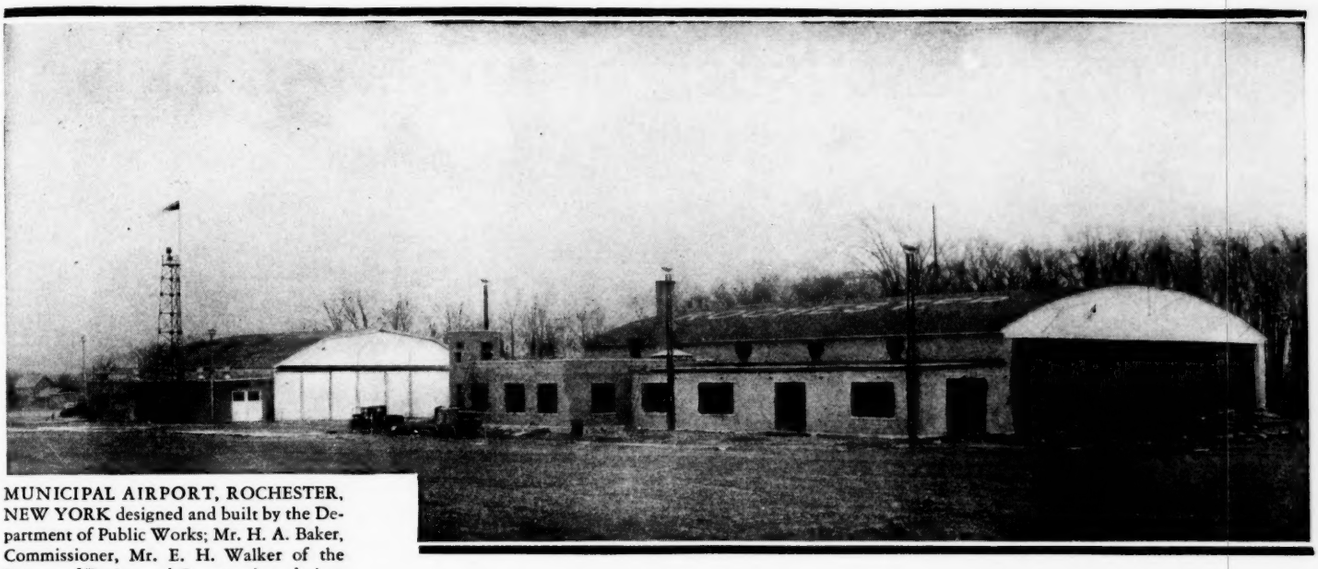
Nelson Corp., Herman, The, Moline, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

WRENCHES, STILLSON

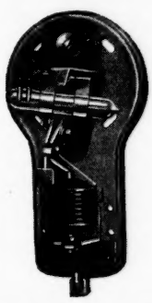
Walworth Co., New York.

ZONE HEATING SYSTEMS

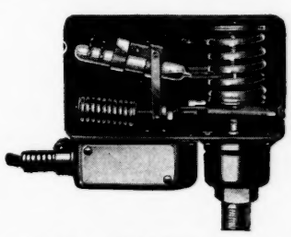
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.



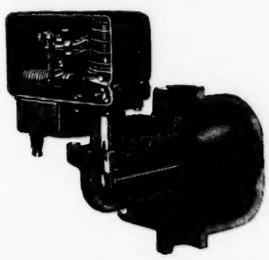
MUNICIPAL AIRPORT, ROCHESTER, NEW YORK designed and built by the Department of Public Works; Mr. H. A. Baker, Commissioner, Mr. E. H. Walker of the Bureau of Design and Construction, designer. Mechanical equipment installed under the direction of Mr. John V. Lewis, Bureau of Maintenance and Operation. Contractor for heating, plumbing and water supply, W. A. Barber.



No. 845 Mercoid for use to make or break an electric circuit according to change in air temperature.



No. 848 Mercoid for pressure or temperature control on steam, air, gas, water, etc., and many special applications.



No. 613 Mercoid provides low water safety control to automatically break the circuit when the water in the boiler falls too low.

This modern municipal airport is completely controlled by

MERCOID

The Rochester Municipal Airport is an excellent example of how Mercoid can furnish absolute control at many different points in industrial plants.

The Unit Heaters manufactured by the American Blower Corporation are controlled by No. 845 Mercoid Thermostats.

The compressors manufactured by Ingersoll Rand Company for furnishing air to the sewage ejectors are controlled by No. 848 Mercoid Pressure Controls.

The boiler is fired by a No. 3 Iron Fireman controlled by No. 848 Mercoid Pressure Control.

Low water safety is secured by means of the No. 613 Mercoid Low Water Cut Off which stops the stoker in case the water level falls too low.

This is only one of thousands of installations of Mercoids in the heating and industrial field. Heating engineers are continually finding new uses for these accurate, rugged and inexpensive controlling devices — zone heating, hot water control, steam, water and air pressure control, unit heater control, stoker control, etc.

Mercoids carry the full line current, 110 or 220 volts, without corrosion of contacts or exposed arc.

A postcard will bring you complete information without any obligation.

ACCESSORIES DIVISION

AMERICAN RADIATOR COMPANY

Dept. MA-5. 40 West 40th Street, New York

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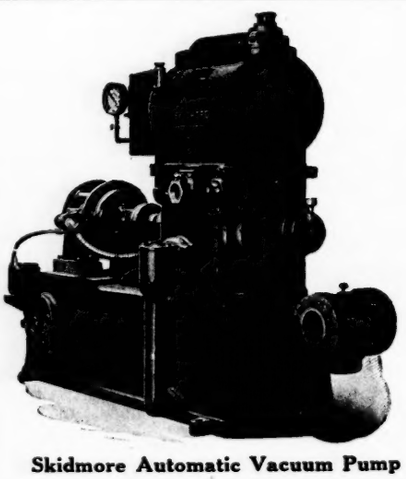
SKIDMORE VACUUM PUMPS
INSURE YOUR JOB



Skidmore Automatic Vacuum Pump

The ratings of Skidmore Pumps are determined by the use of such a large safety factor that their successful operation on any reasonable job is assured. If any pump will handle the job the same size Skidmore will do it better.

WRITE FOR FURTHER DETAILS

SKIDMORE CORPORATION

1535 DAYTON STREET, CHICAGO

REPRESENTED IN PRINCIPAL CITIES

MADE AND SOLD IN CANADA BY DARLING BROS. LTD.—MONTREAL

Wright Aeronautical Corporation
Paterson, New Jersey

Here 85,000 square feet of Celotex Roof Insulation Board provides splendid working conditions all year 'round ... reduces winter heating costs and prevents ceiling condensation. John W. Ferguson, Engineers and Builders. T. F. Sloan Company, Roofers.

Celotex Roof Insulation Board
provides
Better Working Temperatures

HEATING engineers increase plant efficiency by providing temperatures that insure *more* work and *better* work per labor hour. This job of maintaining ideal working conditions becomes very much easier . . . under Celotex-insulated roofs.

For Celotex Roof Insulation Board shuts out sweltering summer heat . . . improves ventilation by preventing rapid variation in temperature.

In winter Celotex prevents heat leakage . . . helps you provide plenty of warmth at considerably less expense. Smaller heating plants and less radiation are required. And the *provable* savings in fuel consumption are far too big to be overlooked.

Besides, Celotex Roof Insulation prevents losses from ceiling condensation—a serious problem in many industrial buildings. And the hazard from contraction and expansion of roof decks is greatly reduced.

Heating engineers recommend and use Celotex Roof Insulation Board not only because its low thermal conductivity is producing important economies in thousands of buildings—but because its *cost of application is low.*

It is quickly and easily applied on new or old buildings — over any type of roof deck, or laid right over old built-up roofing.

The complete data on the actual savings insured by Celotex Roof Insulation have been carefully tabulated for your use.

Write for our booklet *Dividends from Proper Roof Protection.* It has been accepted as authoritative by heating experts from coast to coast.

The word
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(Reg. U. S. Pat. Off.)
is the trademark of and indicates manufacture by The Celotex Company, Chicago, Ill.

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INSULATING CANE BOARD
ROOF INSULATION

30226

MARSH presents *truly modern heating*

One good example of outstanding Marsh engineering is this strikingly new radiator valve.

Modern lines now give distinction to this vital unit. The attractive design is beautifully set off by an enduring two-tone finish, polished surfaces being of lustrous chromium.

Crowning this latest achievement, is the ultra modern control wheel which combines hand fitting comfort with appealing design.

The beauty of Marsh products is more than skin deep. An x-ray of this new Marsh Product shows a modern development of interior design—exclusive with Marsh—with a smooth operating control and sturdy, enduring construction.

See the nearest Marsh representative for complete details of this valve.

Increased activity in rapidly expanding markets has made it necessary to increase the number of our representatives. Sales engineers experienced in these or similar lines are invited to write. If your territory is open, this may mean a valuable connection.

JAS. P. MARSH & CO.

(DIVISION OF COMMERCIAL INSTRUMENT CORPORATION)

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Chicago, Illinois

551 Fifth Ave., New York City **2539 Pennsylvania Ave., N. W.**
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FAMOUS FIGHTERS

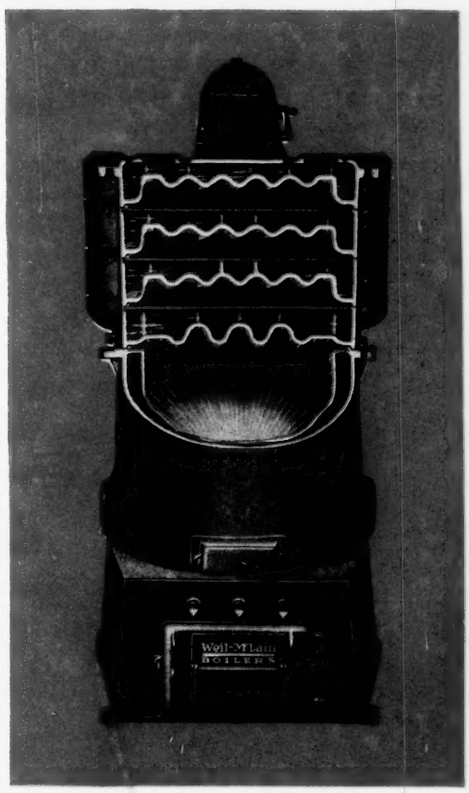
Theodore Roosevelt

(26th President of the United States)

"T. R." was one of the most colorful figures in American politics. Fame first came to him in the New York State Assembly for his stand *against* municipal corruption and *for* civil service reform. Next, his vigorous conduct as Police Commissioner of New York led to the cleaning up of a bad situation in that city. He organized the famous "Rough Riders" and served with them during the Spanish-American War. He also served as Governor of New York State for two years. As president, "T. R." was responsible for: ending the Russo-Japanese War, for which he received the Nobel Peace Prize; taking over the management of Cuban affairs; acquiring rights in Panama to carry on the construction of the Canal; and *for conservation of natural resources.* He was famous for his "Big Stick" fighting qualities.

Weil-McLain fighting features are *selling* features

Weil-McLain Boilers conserve fuel. They are famous for their fighting qualities, too. The fighting features that enable them to deliver more heat and save fuel are easily demonstrated to home owners. These same features make all Weil-McLain Boilers good business builders for you.



Fuel-saving corrugations like this ∿∿∿

Weil-McLain Round Boiler, for example, delivers more heat and saves fuel, because all the vital heat-absorbing surfaces are corrugated like this ∿∿∿ instead of flat like this ———. It is easy to show that the wavy line crowds 30 to 40 per cent more heating surface into the same space.

Balanced back-and-forth fire travel

More heat is actually utilized in Weil-McLain Boilers because Weil-McLain fire travel is not only back and forth but it is *balanced.* Variations in the rate at which boilers operate, due to varying heat demands, do not alter the long, balanced, back-and-forth flow of gases through the flues.

In the complete line of Weil-McLain Boilers you will find scientific principles of design that enable these boilers to fight fuel waste and deliver more heat. The line includes Round Type, Jacketed, Square, Self-feed and Smokeless Boilers. Also Weil-McLain "Cameo" Radiators.

WEIL-McLAIN COMPANY, General Office: Chicago
Boiler Plant and Offices: Michigan City, Ind.
Radiator Plant and Offices: Erie, Pa.

Master Plumbers are invited to visit our space at National Plumbers' Exhibit, Boston, June 24-26

Weil-McLain
SCIENTIFIC COMBUSTION
BOILERS
fight fuel waste and deliver more heat

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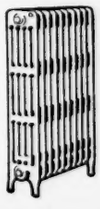


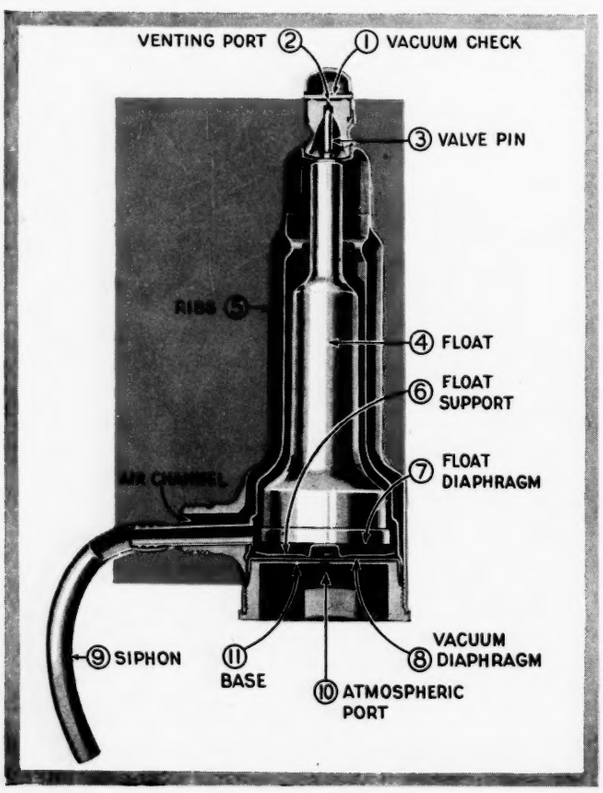
CAMEO
RADIATORS

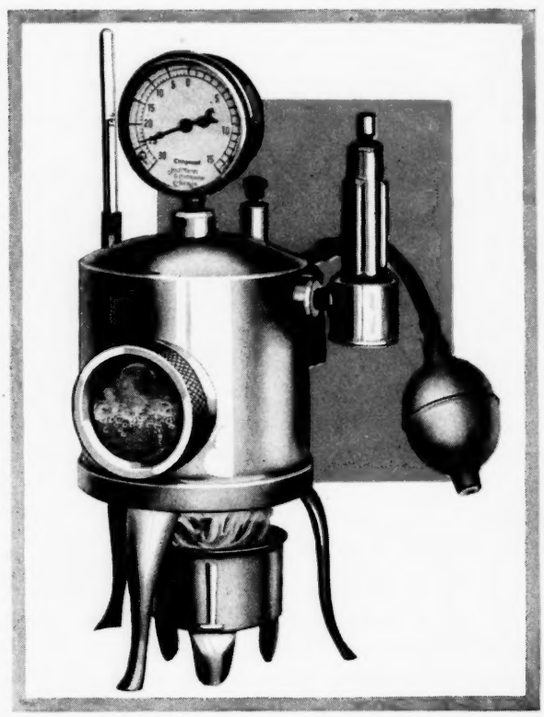
It takes more than a die-stamp to make a valve a Vacuum Valve

IT is easy enough to stamp the word "vacuum" on a valve ... but the real test of a vacuum valve is—*how much vacuum will it pull and how long will it hold a vacuum.*

Hoffman No. 2 Vacuum Valves are ingeniously designed to do the two things that create maximum vacuum. They completely vent the air and then lock it out. They are manufactured with the exacting precision of a watch. The double air lock—an exclusive, patented feature — insures efficient operation whether the radiator has been partially heated or fully heated.

Hoffman No. 2 Valves insure the holding of a high vacuum because the main air lock is operated by a diaphragm that exerts 20 to 50 times greater pressure to hold the port closed than ordinary discs or ball checks.





The advantages of vacuum heating and the high efficiency of Hoffman No. 2 Valves in pulling and holding a vacuum are clearly shown by this demonstration outfit. A Hoffman representative will be glad to demonstrate this in your office upon request.

In installing one-pipe vacuum systems, there is but one way to make sure of satisfactory results. Install Hoffman No. 2 Vacuum Valves on every radiator — vent the mains with Hoffman No. 16 Valves — and install a Hoffman Kompo Gage on the boiler.

These simple changes enable you to offer building owners a vacuum system in which radiators will heat up in 15 minutes instead of an hour—will remain hot for three hours instead of one hour after fires are banked—and will reduce fuel costs about $5.00 per radiator per year (except in mild climates). Hoffman Specialty Co., Inc., Dept. C-64, Waterbury, Conn.

HOFFMAN *Number* 2 VACUUM VALVES

Whereas ordinary vacuum valves depend entirely on a disc or ball check to lock the air out, Hoffman No. 2 Valves have a double check—the vacuum check (1) and the vacuum diaphragm (8). The vacuum check (1) is used only when the radiator has been partially heated and until a 1" vacuum is formed. At all other times it is the vacuum diaphragm which locks the air out and holds the vacuum in the system.